IVAC SYRINGE PUMPS

P5000

TECHNICAL SERVICE MANUAL

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P5 - PCAM

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1.0 GENERAL INFORMATION

1.1 Introduction

The **IVAC PCAM syringe pump** is designed to provide a small self administered dose of analgesic as and when the patient demands it by activating a hand operated button. The clinician can select limits on various parameters, including the size of each individual dose, the minimum time between doses, the number of doses allowed during a period etc.. In parallel to the patient controlled operation the system allows the clinician to set an automatic loading dose which will be delivered on the onset of treatment. Similarly a continuous background infusion which is delivered irrespective of the patients demands for analgesia can also be selected.
In addition the system will automatically record valuable information about each patients treatment and their individual demands for analgesia. This allows later analysis of the frequency with which analgesia is being requested, the total dose delivered etc..

The **IVAC PCAM syringe pump** allows the use of standard disposable syringes and any suitable standard extension line.

Ensure that you are fully familiar with this equipment by carefully studying the operators manual prior to attempting any repairs or servicing.

As part of a policy of continuous improvement, product enhancements and changes are introduced from time to time.

Where the changes do not result in the need for a change in the model and part number of the equipment, these changes are documented via the build status of the unit. Software changes can be identified via the version and revision status of the resident software of the equipment. Other individual changes which do not affect the overall specification or operation of the equipment are documented individually in the schematics attached.

1.2 Registration for Updates

Please complete the registration form on the next page.

****** REGISTER NOW ******

Dear Customer,

In order for us to provide you with ongoing technical support for our products, please help us by completing and returning this registration form to your local ALARIS service centre (addresses overleaf).

Name: _____

Department: _____

Hospital: _____

Address: _____

_____

_____

Postcode: _____

Telephone: _____ **Ext.:** _____

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1.3 General Precautions

Please read the general precautions described in the operators manual carefully prior to using this equipment.

An electrical shock hazard exists if the instrument casing is opened or removed. Refer all servicing to qualified service personnel only.

This instrument is protected against the effects of high energy radio frequency emissions and is designed to fail safe if unreasonable levels of interference are encountered. Should false alarm conditions be encountered either, remove the source of the interference, or, regulate the infusion by another appropriate means.

If the instrument is dropped, subjected to excessive moisture, humidity or high temperature, or otherwise suspected to have been damaged, remove it from service for inspection by a qualified service engineer.

This equipment contains static-sensitive components. Observe strict precautions for the protection of static sensitive components when attempting to repair and service the equipment.

1.4 Installation

Please refer to the Directions for Use for full details of the installation procedure for the equipment.

The operational and alarm tests described in the installation procedure of the Directions for Use perform a functional check of the equipment.

1.5 Warranty

ALARIS Medical Systems (hereinafter referred to as "ALARIS") warrants that :

(A) Each new instrument (pump, controller or peripheral instrument) is free from defects in material and workmanship under normal use and service for a period of one year from the date of delivery by ALARIS to the first purchaser.

(B) Each new accessory is free from defects in material and workmanship under normal use and service for a period of ninety (90) days from the date of delivery by ALARIS to the first purchaser.

If any product requires service during the applicable warranty period, the purchaser should communicate directly with the local ALARIS centre to determine appropriate repair facility. Repair or replacement will be carried out at ALARIS's expense, subject to the terms of the warranty. The product requiring service should be returned promptly, properly packed, and postage prepaid. Loss or damage in return shipment to ALARIS shall be at the purchaser's risk.

In no event shall ALARIS be liable for any incidental, indirect or consequential damages in connection with the purchase or use of any ALARIS product. This warranty shall not apply to, and ALARIS shall not be responsible for, any loss arising in connection with the purchase or use of any ALARIS product which has been repaired by anyone other than an authorised ALARIS service representative or altered in any way so as , in ALARIS's judgement, to affect its stability or reliability, or which has been subject to misuse or negligence or accident, or which has had the serial or lot number altered, effaced or removed, or which has been used otherwise than in accordance with the instructions furnished by ALARIS.

This warranty is in lieu of all other warranties, express or implied, and of all other obligations of liabilities on ALARIS's part, and ALARIS neither assumes nor authorises any representative or other person to assume for it any other liability in connection with the sale of ALARIS products.

See packing inserts for international warranty.

ALARIS DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR OF FUNCTION OF FITNESS FOR A PARTICULAR PURPOSE OR APPLICATION.

2.0 RS232 COMMUNICATIONS INTERFACE

2.1 HOST COMMAND PROTOCOL

Host commands are used to initiate communication between PCAM and a host device - typically a computer. The computer issues a host command consisting of 6 bytes of data after which it waits for a reply. The reply will normally occur within 100ms.

Host commands begin with a sequence of three host header bytes '0xff' (decimal: 255, hexadecimal: ff). The fourth byte is the pump identity number, valid in the range 0 to 127 and 254 (broadcast identity). The last two bytes represent the command itself: the first is an ASCII character, for example 'P' or 'I' and the second is either a binary number or another ASCII character.

COMMAND	DESCRIPTION	EXAMPLE BYTES (0xff 3 times, pump identity eg. 001, 2 byte command)
P#0	Request general configuration	0xff,0xff,0xff,0x01,0x50,0x00
P#1	Request protocol A	0xff,0xff,0xff,0x01,0x50,0x01
P#2	Request protocol B	0xff,0xff,0xff,0x01,0x50,0x02
P#3	Request protocol C	0xff,0xff,0xff,0x01,0x50,0x03
P#4	Request protocol D	0xff,0xff,0xff,0x01,0x50,0x04
P#5	Request protocol E	0xff,0xff,0xff,0x01,0x50,0x05
P#6	Request modified protocol	0xff,0xff,0xff,0x01,0x50,0x06
P#10	Request drug 1 data	0xff,0xff,0xff,0x01,0x50,0x0a
P#11	Request drug 2 data	0xff,0xff,0xff,0x01,0x50,0x0b
P#12	Request drug 3 data	0xff,0xff,0xff,0x01,0x50,0x0c
P#13	Request drug 4 data	0xff,0xff,0xff,0x01,0x50,0x0d
P#14	Request drug 5 data	0xff,0xff,0xff,0x01,0x50,0x0e
P#20	Request PCAM status	0xff,0xff,0xff,0x01,0x50,0x14
L#0 - 25	Set pump identity to n (n valid in range 0 to 127)	0xff,0xff,0xff,0x01,0x49,0x02 (where new identity is 002)
0,EL ?	Event latest - set pointer to latest event and read the event text. The event text will be returned as an ASCII string in a 64 byte message block.	0xff,0xff,0xff,0x01,0x45,0x4C
0,EO ?	Event oldest - set pointer to oldest event in log (maybe invalid data) and read the event text	0xff,0xff,0xff,0x01,0x45,0x4F
0,EF ?	Event forward - move index forward and read the event text	0xff,0xff,0xff,0x01,0x45,0x46

2.1 HOST COMMAND PROTOCOL (cont)

0,EB ?	Event back - move index backward and read the event text	0xff,0xff,0xff,0x01,0x45,0x42
'H' 'D'	Handset demands - returns the text "TOTAL = xxxx GOOD = xxxx". The text will be returned as an ASCII string in a 64 byte message block.	0xff,0xff,0xff,0x01,0x48,0x44
'V' 'I'	Volume infused - return the text "VOLUME = xx.x ml MASS = xx.x mg"	0xff,0xff,0xff,0x01,0x56,0x49

2.2 PCAM INFORMATION SET PROTOCOL

The pump information sets are sent only on receipt of a valid host command. The data is communicated as 64 byte blocks. There are 13 information sets: 1 configuration, 1 status, 6 protocol, and 5 drug data sets.

The information set includes a start byte (0x01), the pump identity number followed by a 2 byte command respond sequence ASCII 'p' and a number reflecting the host command which requested the information. Note that the host command 'P' is responded to by 'p'.

On receipt of data using a computer a 65th byte will normally be received (this has invalid data) and is present to extend the data set long enough to ensure that in the case of RS485 transmission the transmit status is not dropped too early (which could lead to the last data byte being received with an error). The following data is sent in response to host command 'P'0.

CONFIGURATION DATA (INFORMATION SET 0)			
BYTE	DESCRIPTION	EXAMPLE	VALID RANGE
0	Header	0x01	-
1	Identity number	0x01	0x00..0x7f
2	'p' (ASCII)	0x70	-
3	Info set 0	0x00	-
4	Active protocol eg 'C'	0x02	0x00..0x05
5	Active language 0: English 1: French	0x00	0x00..0x01

2.2 PCAM INFORMATION SET PROTOCOL

6	Options 0: 0 1 Bit 0: Modify protocols No Yes Bit 1: Modified protocol set No Yes Bit 2: Extended callback No Yes Bit 3: Sleep after 2 mins No Yes Bit 4: Continuous event print No Yes Bit 5: Chirp low alarms No Yes Bit 6: Nurse call enabled No Yes Bit 7: Comms. enabled No Yes	0xbd	0x00..0xff
7	Options 1: 0 1 Bit 0: Backgrounds allowed No Yes Bit 1: Loading allowed No Yes Bit 2: Max mass allowed No Yes Bit 3: Max period allowed No Yes (must set identical to bit 2) Bit 4: Dose rate variable No Yes Bits 5..7: Not used	0x1f	0x00..0xff
8	Options 2: 0 1 Bit 0: Volume dose mode No Yes Bit 1: Icons displayed No Yes Handset mode A B C Bit 2: 0 1 0 Bit 3: 0 0 1 Bits 4-7: Not used	0x00	0x00..0xff
9	Syringe range 0: Universal 1: Braun Perfusor 2: Janpol	0x00	0x00..0x02
10	Null	0x00	0x00
11..12	Syringe type locked No (0x0000), Yes (non-zero)	0x00, 0x00	0x00,0x00 or 0x00,0x01
13..14	Syringe type default 0x0000..0x000A (BD-Plastipak, IVAC, Terumo, etc).	0x00	0x00,0x00 .. 0x00,0x0A
15	Maximum protocol in use eg. D	0x03	0x01..0x05
16..61	Not used	0x00, 0x00, etc	-
62	CRC High 8 bits (see below)	0x12	0x00..0xff
63	CRC Low 8 bits (see below)	0x34	0x00..0xff

2.3 PROTOCOL DATA INFORMATION SETS 1 TO 6

This data is sent in response to host commands 'P'1 to 'P'6 and represents PCAM protocols A, B, C, D, E and the variable protocol respectively.

BYTE	DESCRIPTION	EXAMPLE	VALID RANGE
0	Header	0x01	-
1	Identity number	0x01	0x00..0x7f
2	'p' (ASCII)	0x70	-
3	Info set 1..5 eg protocol B	0x01	-
4	Protocol with valid range - true: 0xff, false: 0x00	0xff	0x00 or 0xff
5	Not used	0x00	-
6	Not used	0x00	-
7	Not used	0x00	-
8	Drug name index	0x00	0..5 (decimal)
9		0x00	
10		0x00	0x00000000..
11	Selects 1 of 5 drugs	0x03	0x00000005
12	Drug concentration	0x00	0..99900 (decimal)
13		0x00	
14		0x03	0x00000001..
15	In ug eg. 0x000003E8 = 1.00mg	0xE8	0x0001863C
16	PCA dose	0x00	0..99900 (decimal)
17		0x00	
18		0x03	0x00000001..
19	In ug eg. 0x000003E8 = 1.00mg	0xE8	0x0001863C
20	Lockout period	0x00	0..180 (decimal)
21		0x00	
22		0x00	0x00000000..
23	In minutes eg. 0x0005 = 5 minutes	0x05	0x000000b4
24	Occlusion level	0x00	0..10 (decimal)
25		0x00	
26		0x00	0x00000000..
27	Level 0x0004 = 4	0x04	0x0000000A
28	Continuous dose rate	0x00	0..99900 (decimal)
29		0x00	
30		0x03	0x00000000..
31	In ug/h eg. 0x000003E8 = 1.00mg/h	0xE8	0x0001863C

2.3 PROTOCOL DATA INFORMATION SETS 1 TO 6 (cont)

32 33 34 35	Loading dose In ug eg. 0x000003E8 = 1.00mg	0x00 0x00 0x03 0xE8	0..99900 (decimal) 0x00000000.. 0x0001863C
36 37 38 39	Max mass In ug eg. 0x0000C350 = 50mg Note: 0x00000000 = OFF	0x00 0x00 0xC3 0x50	0..999000 (decimal) 0x00000000.. 0x000F3E58
40 41 42 43	Max period In hours eg. 0x00000004 = 4 hours	0x00 0x00 0x00 0x04	1..8 (decimal) 0x00000001.. 0x00000008
44 45 46 47	PCA delivery period In minutes eg. 0x00000005 = 5 minutes Note: 0x0000 = max rate (typ. 100ml/h)	0x00 0x00 0x00 0x05	0..60 (decimal) 0x00000000.. 0x0000003c
48..61	Not used	0x00	-
62	CRC high 8 bits (see below)	0x12	0x00..0xff
63	CRC low 8 bits (see below)	0x34	0x00..0xff

2.4 DRUG DATA INFORMATION SETS 10 TO 15

This data is sent in response to host commands 'P'10 to 'P'15 and represents PCAM drugs 1 to 5 and the full range 6th drug selection.

BYTE	DESCRIPTION	EXAMPLE	VALID RANGE
0	Header	0x01	-
1	Identity number	0x01	0x00..0x7f
2	'p' (ASCII)	0x70	-
3	Info set 10..14	0x0a	0x0a..0xe
	Drug name		
4	character 1	0x44 ('D')	0x20..0x5b
5	character 2	0x52 ('R')	
6	character 3	0x55 ('U')	
7	character 4	0x47 ('G')	
8	character 5	0x20 (' ')	
9	character 6	0x31 ('1')	
10	character 7	0x20 (' ')	
11	character 8	0x20 (' ')	
12	character 9	0x20 (' ')	
13	character 10	0x20 (' ')	

2.4 DRUG DATA INFORMATION SETS 10 TO 15 (cont)

14	Drug name string terminator	0x00	-
15	Not used	0x00	-
16 17 18 19	Minimum drug concentration In ug/ml eg. 0x000001F4 = 0.5mg/ml	0x00 0x00 0x01 0xF4	0..99900 (decimal) 0x00000001.. 0x0001863C
20 21 22 23	Maximum drug concentration In ug/ml eg. 0x000007D0 = 2.0mg/ml	0x00 0x00 0x07 0xD0	Min..99900 (decimal) Min conc.. 0x0001863C
24 25 26 27	Minimum lockout In minutes eg. 0x00000005 = 5 minutes	0x00 0x00 0x00 0x05	0..180 (decimal)
28 29 30 31	Maximum lockout In minutes eg.0x0000000A = 10 minutes	0x00 0x00 0x00 0x0A	Min..180 (decimal)
32 33 34 35	Minimum PCA bolus dose In ug eg. 0x0000000a = 10ug	0x00 0x00 0x00 0x0a	0..99900 (decimal) 0x00000001.. 0x0001836C
36 37 38 39	Maximum PCA bolus dose In ug eg. 0x000007D0 = 2.0mg	0x00 0x00 0x07 0xD0	Min..99900 (decimal) Min dose.. 0x0001836C
40 41 42 43	Maximum continuous dose In ug/h eg. 0x000007D0 = 2.0mg/h	0x00 0x00 0x07 0xD0	0..99900 (decimal)
44 45 46 47	Maximum loading dose In ug eg. 0x00002710	0x00 0x00 0x27 0x10	0..99900 (decimal)
48..61	Not used	0x00	-
62	CRC high 8 bits	0x12	-
63	CRC low 8 bits	0x34	-

2.5 STATUS DATA INFORMATION SET 20

This data is sent in response to host command 'P'20 and represents the current PCAM status. The data in this set is READ ONLY and is not set in the Learn mode.

BYTE	DESCRIPTION	EXAMPLE	VALID RANGE
0	Header	0x01	-
1	Identity number	0x01	0x00..0x7f
2	'p' (ASCII)	0x70	-
3	Info set 20	0x14	-
4	Software version character 1	0x31 ('1')	-
5	character 2	0x52 ('R')	-
6	character 3	0x34 ('4')	-
7	Software CRC checksum high	0xa2	-
8	byte	0x31	-
	low byte		
9	Alarm status 0 1 Bit 0: active alarm No Yes Bits 1..4: not used Bit 5: ac alarm active No Yes Bit 6: in low battery period No Yes Bit 7: intermittent tone No Yes	0x00	0x00..0xff
10	General status 0 1 Bit 0: hand switch in No Yes Bit 1: battery operation No Yes Bit 2: near end of syringe No Yes Bit 3: cover open Bit 4: drive declutched No Yes Bits 5..7: not used	0x11	0x00..0xff
11	PCA status Bit 0: syringe confirmed No Yes Bit 1: pca started No Yes Bit 2: loading infusion active No Yes Bit 3: background only active No Yes Bit 4: pca dose active No Yes Bit 5: lockout period active No Yes Bit 6: clin. bolus/continuous No Yes Bit 7 drive engagement pulse No Yes	0x00	0x00..0xff
12	Volume infused	0x00	
13		0x00	
14	In 0.1ml units from 0ml to 9999.0ml	0x00	0x00000000..
15	eg. 0x0000000A = 1.0ml	0x0a	0x00018696

2.5 STATUS DATA INFORMATION SET 20(cont)

16 17 18 19	Mass infused In 0.1ug units from 0.1ug to 9999mg eg. 0x00002710 = 1.0mg	0x00 0x00 0x03 0xe8	 0x00000000.. 0x05F5B9F0
20 21	Good demands high byte low byte	0x00 0x01	 0x0000..0x270f
22 23	Total demands high byte low byte	0x00 0x01	 0x0000..0x270f
24	Syringe cal. base value	0x40	0x00..0xff
25	Syringe cal. per 19mm offset	0x61	0x00..0xff
26 27	Occlusion cal. base value: 0kgf high byte low byte	0x00 0x02	 0x0000..0xffff
28 29	Occlusion cal. bits per 4kgf high byte low byte	0x00 0x60	 0x0000..0xffff
30	Syringe type and size 8 x type + size eg BD Plastipak 50ml	0x02	0x00..0xff
31..61	Not used	0x00	-
62	CRC high 8 bits	0x12	-
63	CRC low 8 bits	0x34	-

2.6 COMMUNICATIONS SET CRC CHECKSUMS

The information in the data sets above is communicated in 48 bytes blocks with the last two bytes reserved for a 16 bit CRC which is performed on the data set before transmission from the PCAM. This CRC can be used to verify correct data reception by calculating the CRC on the first 46 bytes of the received data and then comparing with the 2 byte CRC value.

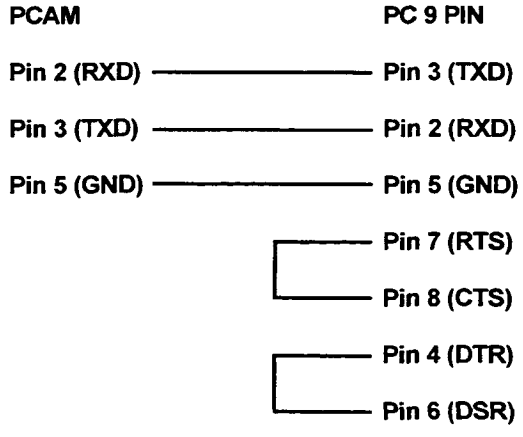
The CRC uses a standard generator polynomial 0x11021. A suitable 'PASCAL' subroutine to generate the CRC is shown below. The result word r must be zero at the start. The function is called once with each received data byte, passed to the crc16( ) function in x. On completion of the 46 calls to the function the result word r can be compared to the 16 bit value produced by the 2 CRC bytes sent from the PCAM.

```
procedure crc16(x: byte; var r: word);
{ CRC - Generator polynomial = 11021 hex = x16+x12+x5+1}
const
 g = $1021;
var
 i: byte;
begin
 for i := 1 to 8 do
 begin
  if (r and $8000) = 0 then
  begin
   if (x and $80) = 0 then r := r shl 1
                 else r := (r shl 1) xor 1;
  end
   else
  begin
   if (x and $80) = 0 then r := (r shl 1) xor g
                 else r := (r shl 1) xor g xor 1;
  end;
  x := x shl 1;
 end;
end;
```

2.7 RS232 INTERFACE SPECIFICATION

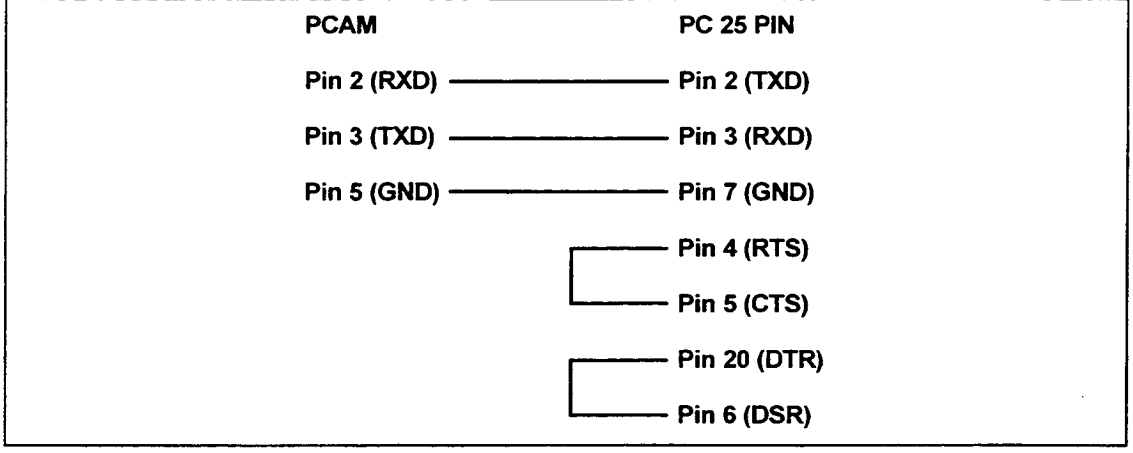
RS232 SPECIFICATION	
CONNECTOR	9-pin D Type (Male Connector on PCAM)
RX/TX	EIA RS232-C standard
TX OUTPUT VOLTAGE RANGE	Min. -5V (mark), +5V (space) Typ. -7V (mark), +7V (space) (3kohm load)
RX INPUT VOLTAGE RANGE	-15V to +15V max
RX INPUT THRESHOLDS	Low: 0.6V min High: 3.0V max
RX INPUT RESISTANCE	3k ohm min
ISOLATION SOCKET/PUMP	4kV (dc, or ac peak)
BAUD RATE	9600 baud
BIT FORMAT	1 start, 8 data, odd parity, 1 stop
Pin 2 - RXD	RX - receive data
Pin 3 - TXD	TX - transmit data
Pin 5 - GND	0V Ground

WIRING DIAGRAM (PCAM TO 9 PIN COMMS. CONNECTIONS)



2.7 RS232 INTERFACE SPECIFICATION (cont)

WIRING DIAGRAM (PCAM TO 25 PIN COMMS. CONNECTIONS).

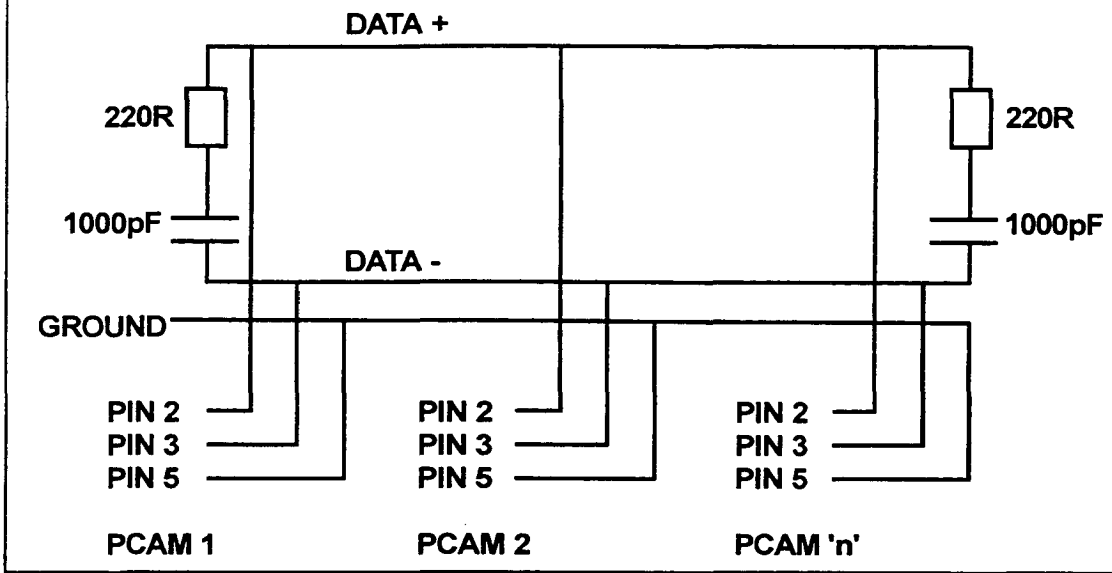


2.8 RS485 INTERFACE SPECIFICATION

CONNECTOR	9-pin D Type (Male Connector on PCAM)
RX/TX	EIA RS485 standard
DIFFERENTIAL DRIVER O/P VOLTAGE	2V to 5V
DRIVER COMMON MODE O/P VOLTAGE	3V (max)
BUS COMMON MODE VOLTAGE	-7V to +12V
RX INPUT RESISTANCE	12kohm min
RECOMMENDED TERMINATION	220ohm resistor in series with 1000pF capacitor at each end of the bus
ISOLATION SOCKET/PUMP	4kV (dc, or ac peak)
BAUD RATE	9600 baud
BIT FORMAT	1 start, 8 data, odd parity, 1 stop
Pin 2 - DATA+	Balanced data positive
Pin 3 - DATA-	Balanced data negative
Pin 5 - GND	0V Ground

2.8 RS485 INTERFACE SPECIFICATION (cont)

WIRING DIAGRAM (PCAM TO RS485 BUS).



RS485 - INTERFACE PIN-OUT

PCAM 9-PIN INTERFACE	PIN NUMBER	PRINTER CONNECTIONS
ALM INPUT (active low)	1	-
RXD2/data+	2	RS232 receive input or RS485 data +
TXD2/data-	3	RS232 transmit output or RS485 data -
PWR1 (+10V)	4	-
GND	5	Ground
RXD1	6	-
RTS1	7	-
CTS1	8	-
TXD1	9	-

RESPIRATION INTERFACE

The respiration alarm input allows PCAM infusion to be stopped and an alarm to occur if the input is set active. A common use of this interface would be to connect the PCAM to a respiration monitor.

The alarm input pin should be connected to an open collector transistor drive with pin 5 connected to the interface ground; alternatively a set of relay contacts can be connected between the interface pins 1 and 5. When the transistor is off or the relay contacts open the PCAM functions normally. If the transistor is switched on or the relay contacts close and the PCAM infusion is started the device will stop infusing and alarm with 'RESPIRATION ALARM' displayed. The maximum current sink into an open collector transistor is 10mA.

2.8 RS485 INTERFACE SPECIFICATION (cont)

PCAM INTERFACE PIN-OUT		
PCAM 9-PIN INTERFACE	PIN NUMBER	PRINTER CONNECTIONS
ALM INPUT (active low)	1	Alarm input - active if connected to pin 5
RXD2/data+	2	-
TXD2/data-	3	-
PWR1 (+10V)	4	-
GND	5	Ground
RXD1	6	-
RTS1	7	-
CTS1	8	-
TXD1	9	-

PCAM NURSE CALL INTERFACE

The nurse call interface allows connection to a conventional nurse call system. Inside the PCAM a single relay contact is open during normal operation of the pump. If the PCAM alarms or the power is switched off the relay contacts close activating the nurse call circuit. The two nurse call contacts are made with the Lemo connector pins - they are not polarised. The connector shell is not connected to the interface.

NURSE CALL SPECIFICATION	
NURSE CALL	SPECIFICATION
MATING CONNECTOR	R/A PLUG LEMO (FHG OB 302 CNAD25) IVAC Part no. 0000EL00257
RELAY CONTACT	30V dc, 1 amp
PCAM normal running	Relay contacts open circuit
PCAM alarming	Relay contacts closed circuit
PCAM power off	Relay contacts closed circuit

3.0 PRODUCT FEATURES, UPDATES AND ENHANCEMENTS

Product updates and enhancements are generally identified by the version and revision status of the resident software of the equipment.

The software status may be interrogated by following the self test procedure described in this service manual.

The following sub-sections describe the updates and enhancements that have been introduced during ongoing development of our range of syringe pumps.

3.1 Summary Guide to Software revision: 5000EL00041

Issue	Description
V1R0	Production Release
V1R1	Sync. history added. Nurse Call features added. Printer features added. General options added to access nurse call enable, comms id and continuous print mode.
V1R2	Video ram test added. Alarm mute added.
V1R3	STOP button enhanced to stop infusions in sleep mode directly. Max. dose limits can be set OFF. Clock was slow to update when in sleep mode, (showed incorrect time), this has now been fixed. French language text added. Handset LED turned off in the lockout phase. Handset alarm added. Teach and Learn introduced.
V1R4	Er1 detection modified to avoid false alarms.
V1R5	Max. dose limit check frequency increased to check every 2 seconds and at START. Nurse call relay test added to self test routine. ENTER and NEXT soft keys added to Access Code screens. In general options 'BACKGROUND INFUSIONS' was changed to 'CONTINUOUS INFUSIONS'.
V1R6	Rapid motor pulse width control added.

3.2 Summary Guide to Software Revision: 5000EL00057

Issue	Description
V2R0	Language options: English, French and German. Dosing mode has been introduced. Separate handset operation modes (were A, B) to give A, B, C which seem to meet the requirements of users who do not want the handset light to extinguish (since the patient should be aware that the lamp is lit or flashing at all times): Handset Modes A, B, C. Self cancel certain alarm conditions following mute: 4.1 Cover closed. 4.2 Handset replaced. Battery Operation and Near End of syringe messages added. Extended Callback added. Rapid Sleep added. Maximum Limit on run display added. Repeated alarm - on mute after 2 mins added. Backlight off during sleep mode added. Pressure icon (top) with a tapered indicator added. Maximum dose icon (lower) indicates a glass bottle added. Reset service log confirm stage added. Comms Protocol. This has been drastically modified to cope will volume dosing and the extended mass dose ranges down to single ug units. Because of these changes it was necessary to change the size of the variables storing the drug limit and protocol information. 16 bit cyclic redundancy checks have been added to each information set. CRCs are an efficient and highly reliable method of standard protocol error protection. When the user receives data they can ignore the CRC if it is not required - however it is an essential part of the learn mode protocol. It will be necessary to include both V1 software and V2 software comms. information sets in the directions for use. Furthermore it is NOT possible to use TEACH / LEARN mode between pumps with V1 software and V2 software.

Issue	Description
V2R1	Language options: German and Dutch introduced. Continuous maximum limit shown as 20.0ml/h. NEOI flag detection clear on declutch. Check 30min period from low battery. Display mode update every 0.5sec. Drug name defaults "MED 1" introduced.
V2R2	Dutch text modified. Speed constant adjustment. 24 Hour log clearing at power up.
V2R3	Dutch text modified. Max dose modifications. Callback timer accuracy 1%. Power up watchdog. The power-up watchdog tests were revised to self repeat if a test appeared to fail.
V2R4	Error Codes Er32 to Er38 introduced. Volume Measurement. A check for negative volumes caused by the motor gearbox momentarily unwinding at the end of a bolus was added. Watchdog Timing. Max dose icon corrected. Clinician Bolus volume adjustment to add continuous rate.
V2R5	Max Dose log anomaly in volume mode. False syringe alarms.
V2R6	Swedish Language added. Maximum limits programmable for Loading Dose, Continuous Dose and Lockout Limits. Syringe Type Locking added. Occlusion Limits increased to allow epidural sets with filters. Occlusion icon display changed to match the P3000 and P7000. Drug name entry speed improved. PCA lockout retained if the pump is switched to SET and then to RUN before the lockout expires. PCA Dose of 0mg available to prevent handset deliveries for epidural use. Occlusion levels now selectable with each protocol. Addition of Evans Rapiject Syringe.

3.3 Summary Guide to Build Revision : 5000ME00020

ALARIS MEDICAL SYSTEMS Bill of Materials Print
Item Number: 5000ME00020 P5000 Family Iss: 78

PCD: 600	Iss: 17 UNIT LABEL SET INTRODUCED, INDIVIDUAL SERIAL NUMBER, ISSUE STATUS AND BOX END LABELS REPLACED WITH A COMBINED LABEL.
PCD: 599	Iss: 18 ADD 1001FAOPT94 USA CORD OPTION TO V4 AND P5 BOM. DELETE THE 5001FAOPT'S 90-94 FOR THE POWER CORD AND REPLACE WITH THE 1001FAOPT'S 90-94.
PCD: 613	Iss: 19 5000ME00020 18 TO 19, FLEXI UPISSUE 1000SP01006 ISSUE 4 TO 5
PCD: 606	Iss: 20 5000ME00007 - FINISH TO BE STAIN STEEL.
PCD: 630	Iss: 21 PLASTIC BAG REMOVED
PCD: 571	Iss: 22 CHANGE ROD SUPPORT TO MOULDED.
PCD: 573	Iss: 22 CHANGE 500ME00043 TO 0000ME00186.
PCD: 628	Iss: 23 SEALING CORD.
PCD: 597	Iss: 24 5001FAOPT02 OPTION TO BE MADE STANDARD.
PCD: 658	Iss: 25 PLASTIC BAG IS TO BE FITTED BEFORE THE PUMP IS SHIPPED.
PCD: 575	Iss: 26 CHANGE 5000ME00046 TO 0000ME00188.
PCD: 625	Iss: 27 ADD FERRITE CORE TO RS232 DEMO CABLE, RS232 PRINTER CABLES AND HANDSET CONNECTORS.
PCD: 657	Iss: 28 WASHER CHANGE ON KEYSWITCH.
PCD: 665	Iss: 29 INTRODUCTION 5000LB00020.
PCD: 664	Iss: 30 5000ME00082 ITEM TO BE DELETED FROM 5000ME00020.
PCD: 513	Iss: 31 MOULDED TRANSMISSION SPACER
PCD: 492	Iss: 32 SYRINGE SHAFT CIRCLIP CHANGE.
PCD: 570	Iss: 33 HINGE BUSH CHANGE TO MOULDED PART.
PCD: 706	Iss: 34 ITEMS 38 5000ME00035, 39 5000ME00036 TO BE SUPERSEDED BY SINGLE COMBINED PART 5000ME00079.
PCD: 715	Iss: 35 JANPOL/BRAUN ADDED.
PCD: 634	Iss: 36 CHANGE OUTER TUBE SUPPLIER AND MANUFACTURING PROCESS.
PCD: 718	Iss: 37 1000ME01087 TO BE SUPERSEDED BY 1000ME01090.
PCD: 709	Iss: 38 5000ME00021 SPACER BUTTON FRONT PANEL REPLACE WITH MACHINED CLIP-ON PART 5000ME00072.
PCD: 713	Iss: 39 SLOTTED SCREWS TO BE REPLACED BY POSI SCREWS.
PCD: 717	Iss: 40 BEAM ASSEMBLY 1000SP00003 ADDED.
PCD: 742	Iss: 41 IMPROVE SURFACE FINISH AND CONCENTRICITY OF THE OUTER TUBE.

PCD: 738	Iss: 42 INTRODUCTION OF 1000EL00137 TO P1000/2000/3000/5000.
PCD: 749	Iss: 43 CE MARKING ADDED TO V4 AND P5 UNITS. ADD CE MARKING TO ARTWORKS OF V4 AND P5 BASE LABELS/LABEL SETS.
PCD: 755	Iss: 44 REPLACE THREE SCREWS ON LINEAR GRID.
PCD: 655	Iss: 45 MOTOR SUPPRESSION ADDED TO FLEXI CIRCUIT.
PCD: 741	Iss: 46 5000PP00001 INTRODUCTION OF HARD TOOLED P5000 CASES. ADD NEW POWER SUPPLY UNITS TO P5000, 5000EL00060/61.
PCD: 728	Iss: 47 5000EL00062 INTRODUCED. 5000SP00027 INTRODUCED. 5000ME00027 INTRODUCED. 5000ME00026 INTRODUCED.
PCD: 756	Iss: 48 IMPLEMENT NEW LEADSCREW SEAL 1000ME01095 TO REPLACE. 1000ME01081. REPLACE O RING 0000ME00185 WITH NEW PART 0000ME00237.
PCD: 770	Iss: 49 SHIP ALL P5000 UNITS WITH FOUR KEYS.
PCD: 765	Iss: 50 SILICONE CORD MODIFICATION 1000ME01090 TO BE REPLACED WITH 1000ME01087 ON P5 UNITS.
PCD: 716	Iss: 51 SUPERSEDE 1000ME00089 WITH PRE-BONDED COUPLING VERSION.
PCD: 865	Iss: 52 REMOVE ONE OF THE SEALING WASHERS 0000ME00219.
PCD: 834	Iss: 52 UPISSUE P5000 BUILD STATUS TO REFLECT THE FITTING OF 2 KEYSWITCH SEALING WASHERS.
PCD: 795	Iss: 52 FRONT PANEL LABEL OVER ALL LENGTH AMENDED. COVER DIMS AMENDED.
PCD: 907	Iss: 53 ADDITION OF STAR WASHER TO NURSECALL CONNECTOR.
PCD: 912	Iss: 54 REPLACE POSI HEAD SCREWS 0000ME00222 WITH SNAKE EYE SCREWS 0000ME00166.
PCD: 913	Iss: 55 P5000 KEYSWITCH LOCK ASSEMBLY REDESIGNED.
PCD: 921	Iss: 56 AMEND LATCH ASSEMBLY ON THE P5000 COVER. REMOVE 0.5mm FROM OVERALL THICKNESS.
PCD: 955	Iss: 57 5000EL00055 SUPERSEDED BY 5000EL00065.
PCD: 851	Iss: 58 IMPLEMENT MOULDED POLE CLAMP PAD AND KNOB/STUB.
PCD: 905	Iss: 5 TORSION ROD 1000ME01015 REPLACED BY TORSION ROD 7000ME00015
PCD: 965	Iss: 60 INCLUDE THE STAR WASHER SUPPLIED WITH 5000ME00027 TO HANDSET CONNECTOR ASSEMBLY
PCD: 979	Iss: 61 RETURN TO OLD POLE CLAMP ASSEMBLY.
PCD: 937	Iss: 62 MODIFICATION TO BODY SPRING MECHANISM.
PCD: 1008	Iss: 63 CHANGE TO ONE PIECE POLE CLAMP KNOB/STUD.
PCD: 1030	Iss: 64 CHANGE SNAKE EYE SCREWS TO POZI EQUIVALENT ON P5000.
PCD: 1077	Iss: 65 FLEXI ROUTING CHANGED.
PCD: 1078	Iss: 66 IMPLEMENT FLEXIBLE CIRCUIT ON BEAM

ASSEMBLY.

PCD: 1072 Iss: 67 IMPLEMENT MOULDED PCAM COVER. IMPLEMENT MOULDED COVER ASSEMBLY COMPONENTS.

PCD: 1009 Iss: 68 MOULDING OF GEAR WITH HOLES.

PCD: 1135 Iss: 69 FOLD OVER CAP ADDED TO RS232 GASKET.

PCD: 1087 Iss: 70 IMPLEMENTATION OF NEW SEALS ON TRANSMISSION TO RECTIFY FLUID INGRESS PROBLEMS.

PCD: 1168 Iss: 71 MOULDING OF BUTTON PLUNGER HOLDER.

PCD: 1167 Iss: 72 MOULDING OF LEADSCREW SEAL.

PCD: 1010 Iss: 73 MOULDNG OF MOTOR MOUNTING PLATE BUSH.

PCD: 1144 Iss: 74 CREATE NEW SWAGED POLE CLAMP ASSEMBLY.

PCD: 1152 Iss: 75 P5000 COVER/MAGNET HOLDER MODS.

PCD: 1090 Iss: 76 1000LB01010 AS AN OPTION (1001FAOPT0F, 5001FAOPT0F, 6001FAOPT0F AND 7001FAOPT0F).

PCD: 1223 Iss: 77 CHANGE RS232 BASE PLATE SECURING SCREWS TO STAINLESS STEEL.

PCD: 1225 Iss: 78 CHANGE CONNECTOR ON BEAM ASSEMBLY.

3.4 Engineering Updates And Interchangeability

4.0 CIRCUIT DESCRIPTION

The circuitry within the **PCAM** syringe pump is contained on four printed circuit boards - Power Supply, Control, Display and Interface PCBs. In addition, a flexible printed circuit is utilised to hold the optical sensors and to provide the necessary interconnects to the moving parts of the pump.

The circuit description for each of the printed circuit boards is covered in the following sections.

4.1 Power Supply PCB.

Refer to the circuit diagram, component location drawing and parts list in section 5.

The Power Supply PCB is located in the lower case assembly of the pump, refer to section 7 for disassembly and removal.

All connections between the Power Supply PCB and the Control PCB are made via PL5.

4.1.1 Mains Input (AC Power)

The pumps can be operated either from 110/120V or 220/240V AC power supplies depending on the configuration of the links on the power supply PCB.

(LK1 & LK3 for 110/120V, or LK2 for 220/240V - these links are made using insulated wire on the non-component side of the PCB).

AC power is applied to the unit using a standard IEC connector from which an internal connection takes the AC power to the power supply PCB via PL1. A ferrite on the mains inlet is fitted to protect the unit from electrical interference; on the PCB a metal oxide varistor, D10, protects against over voltage surges and R23 & C6 filter low frequency interference. The live connection is protected by fuse, FS1.

4.1.2 Rectification

The AC supply voltage is stepped down using transformer TR1, which has two 7.5V secondary windings in parallel. The output from the transformer is then rectified by bridge rectifier, D2.

The output from the bridge rectifier is then diverted two ways, one is routed through D3, the power connection terminals of the keyswitch and back to C5 which smoothes the unregulated supply (marked VIN and MOTVIN). The other output is not smoothed but is supplied to the battery charging and AC signal detect circuits.

4.1.3 Battery Charging

The internal lead acid battery is automatically recharged whenever it is connected to the AC power supply.

When AC power is applied to the pump, the unsmoothed output from the bridge rectifier, D2, is connected to the input of the variable voltage regulator, IC1. The output voltage from IC1 is altered by adjusting the potentiometer, RV1.

The peak output voltage from IC1 should be adjusted to 7.0V +/-0.1V for effective battery charging. The output current from IC1 is limited by R3. The battery must be disconnected whilst making any adjustments to RV1 in order to see the peak battery charging voltage changes.

Diodes D10 and D11 protect the battery from overcharging in the event of failure of IC1. These zener diodes limit the maximum battery terminal voltage to 7.5 volts.

The battery is protected against short circuit by a fuse FS2, rated at 2A. FS2 is a Picofuse type and is soldered directly on the PCB next to PL3. Fuse FS3 provides a separate ground connection for the audible alarm such that if fuse FS2 were to blow a continuous alarm would sound if the unit is running on its internal battery.

4.1.4 AC Power Present Signal

When AC power is connected to the pump the output from the bridge rectifier is connected to R11 and D9 to produce a high signal to the control PCB via PL5. If the AC supply is removed from the pump, the voltage is removed and the output signal changes to 0 volts.

The drive voltage for the AC power LED on the display PCB is sourced from the output of the bridge rectifier and is fed through R12 to the control PCB.

4.1.5 Audible Alarm

The audible alarm is located on the power supply PCB and can be enabled either by the audible alarm drive, or the watchdog alarm signal. In the event of PL5 not being connected or in the event of FS2 failure whilst operating on battery the audible alarm will sound.

4.1.6 Motor Supply Current

The motor supply current is drawn on the control PCB from tracks marked MOTVIN and MOT0V on the power PCB and connected via PL5.

4.1.7 Supply Voltage Detection

The unregulated input supply voltage is fed via R14, R10 and R9 to PL5. The potential divider results in the microcontroller measuring a third of the input supply voltage. This measurement determines the low battery detection of the **PCAM**.

4.1.8 PCA Switch

The PCA Switch connector PL4 provides power which the system can switch on to the handset LEDs and also feeds a voltage from the switch in the handset back to the control PCB. Four voltage bands are used by the **PCAM** to distinguish the conditions handset disconnected, connected with patient switch not pressed, patient switch pressed and a cable short circuit fault.

4.1.9 Keyswitch

The front panel electrical keyswitch has three positions. In one position the power to the unit is isolated leaving only the battery charger operational on mains. In the other positions power is supplied via PL2 pins 1 and 2. In the RUN position a logic signal from pin 3 is pulled to 0V (pin 4) so that the microcontroller and its software can determine the switch position.

4.2 Control PCB

The Control PCB is located in the upper case assembly of the pump.

Refer to the circuit diagram, component location drawing and parts list in section 5.

4.2.1 5 Volt Regulation

The input to the 5 Volt regulator, IC18, is supplied from the power PCB. The 5 Volt output from the voltage regulator is split into two supply rails, Vcc, and Analogue Vcc.

Output zener diodes protect the Control PCB components if IC18 fails short circuit; diodes D7 and D8 limit the absolute maximum voltage on the '5V' supply to 5.6V.

4.2.2 Microcontroller, Program Memory and RAM

The microcontroller, IC5, is a low power CMOS device with one-time-programmable program memory, definable input/output pins, interrupt inputs, internal RAM and 8 channel analogue-to-digital converter.

The clock frequency of 12.000MHz is generated by crystal, X2, and the internal circuitry of the IC and internally divides to form a system clock of 6.000MHz.

The software program is held in the EPROM (or in the microcontroller in pumps fitted with V1 control boards 5000EL00010). Internal RAM and registers are defined in the address range 0F680H to 0FFFFH. A 32k x 8 bit static, battery backed RAM, IC4, stores data. The input/output ports are supplemented by additional input and output latches (IC9 and IC15).

4.2.3 Power Supply Supervisor

The power supply voltage is monitored by IC6 which provides an active low reset signal to the microcontroller at power up and if the regulated 5V input falls below a preset level. IC6 also switches battery backup power to the static RAM IC4 and real time clock chip IC13. The RAM chip select line is protected via IC6 to prevent spurious writes to RAM whilst the reset signal is active.

4.2.4 Input Port Expansion

The input capabilities of the microcontroller have been expanded by adding a data latch, IC9, on the data bus. The outputs from this latch are tri-state until its /OC pin is taken low by the address decoder, IC7. The input data is read by the microcontroller via the data bus.

4.2.5 Output Port Expansion

The output capabilities of the microcontroller have been expanded by adding a data latch, IC15 on the data bus. The output latch is addressed by the address decoder, IC7.

4.2.6 Real Time Clock

The real time clock chip, IC13, runs all the time and uses a 32.768KHz crystal X3 to maintain accurate time and date information. It is interfaced to the microcontroller using a Phillips I^2T 2 wire bus.

4.2.7 Pumping Pressure Measurement

The pumping pressure of the pump is detected by measuring the deflection of a beam at the end of the leadscrew on the transmission by using a full bridge strain gauge.

The output from the strain gauge is applied to the control PCB, via PL1, and fed to a 2 stage differential amplifier, IC1. A positive pressure signal appears on IC1-14 and an inverted signal appears on IC1-7 which is a valid output voltage when negative pressures exist on the beam.

The offset value of the amplifier i.e. with no pumping pressure applied, can be adjusted using potentiometer RV1, and is set during calibration.

The excitation voltage supplied to the bridge is turned off using TR1, controlled from an output port of the microprocessor.

An offset is switched in and out of circuit during normal use by TR2. This offset adds a known voltage offset to the signal fed to the A to D converter. This allows the software to check the correct gain in the 2 stage differential amplifier.

The outputs from the amplifier, IC1 are fed into the input of the A to D converter stage of the microcontroller.

The current in the strain gauge bridge is monitored by resistor R8 and an input to the A to D converter.

4.2.8 System Integrity Checks

The reference voltage created by D6 is used for comparison in software to check that the 5V supply voltage is within acceptable limits. In addition this voltage provides an accurate reference against which to measure the input supply voltage and so determine the low battery alarm level.

4.2.9 AC/DC Input

The AC/DC input level is a high or low signal from the Power Supply PCB. The signal from the Power Supply PCB is high at PL6 when AC is connected and low when the unit is being operated from its internal battery.

4.2.10 Motor Drive and Speed control

The motor speed is controlled by adjusting both the mark-space ratio of the drive signal and its repetition rate applied to the DC motor.

Feedback from the motor is obtained using two optical switches monitoring the movement of the rear output shaft of the motor.

The DC motor is driven using three independent transistor stages, TR7 (watchdog controlled), and TR3 and TR4 (microcontroller controlled). When the pump is started TR3 is enabled via TR10 directly from the output port of the microcontroller. The drive signal to TR4 is from the expansion output port, IC15. Both these signals are adjusted to maintain a constant syringe drive speed. When the pump is stopped both TR3 and TR4 are disabled. In normal operation TR7 is held on by the watchdog inhibit signal being high; however if the watchdog fails TR7 is switched off preventing power reaching the motor.

The motor speed control algorithm uses three feedback signals from the optical switches, the leading optical encoder, the lagging optical encoder and the inverse of the leading optical encoder. Two of these signals drive hardware interrupts on the microcontroller the other is monitored so as to determine the direction of motor rotation. The optical encoder signals are all fed via schmitt trigger inverters in IC14.

4.2.11 Watchdog

The watchdog circuit consists of two D type flip-flops IC3, a ripple counter IC2 with a crystal input X1 (32.768KHz), and logic circuitry of IC11 and IC12.

The circuit needs to be periodically serviced to prevent the ripple counter from overflowing and activating the alarms. In addition if the circuit is serviced too rapidly the alarms will be activated on assumption that the crystal frequencies of either X2 or X1 (connected to the microprocessor) are no longer correct.

The first flip-flop IC3a is triggered every 5ms by being clocked from the address decoder IC7. The alternating high-low signal on data bus bit 0 produces an output signal of 100Hz on the Q output of the D flip-flop.

This signal is then AC coupled and fed to the clear CLR input of the ripple counter IC2 to reset the current count. The output of the ripple counter on pins 13, 14 & 15 synchronise with the trigger signal to IC12-12 and the alternating high-low input to IC11-9 to ensure the IC2 is cleared within a certain time interval. If it is cleared too early or too late the IC3b is clocked to set a watchdog alarm. A watchdog alarm will enable the audible alarm to the power PCB and disable the motor supply current.

In addition the timeout period and the watchdog circuit is tested as part of the power-on self-test routine.

4.2.12 Linear Travel Monitor

The linear movement of the pump transmission is monitored using a slotted optical switch, known as the linear speed opto, coupled with a linear grid.

As the optical switch moves over the slots in the linear grid, the signal from its output changes state. This signal is applied to a schmitt trigger, IC14, via PL5. The output from the schmitt trigger is then be read by the microcontroller via the expansion input port, IC9.

The LED in the optical switch is switched on and off by TR9 so that the operation of the optical device can be self tested during normal operation.

4.2.13 Near End of Infusion Detection

The near end of infusion point is detected using a slotted optical switch which is mounted on the motor mounting plate of the transmission assembly.

The signal from the optical switch changes state, thus detecting a near end of infusion, when a flag which is mounted on the transmission carriage passes through the slot in the optical switch. The change of state position is independent of the actual syringe near end of infusion point. The change of state initiates a count down to the near end of infusion alarm point in software. The countdown depends upon the syringe type and rate of infusion.

This signal is applied to a schmitt trigger, IC14, via PL5. The output from the schmitt trigger is then be read by the microcontroller via the expansion input port IC9.

The LED in the optical switch is switched on and off by TR9 so that the operation of the optical device can be self tested during normal operation.

4.2.14 Syringe Plunger Detection

The syringe plunger button position is detected using a slotted optical switch which is mounted inside the plunger holder. The signals are connected via the plunger detect flexible circuit which passes down inside the transmission outer tube.

The signal from the optical switch changes state when the syringe plunger is located correctly; this signal is fed via a schmitt trigger IC16 to input port IC9.

The LED in the optical switch is switched on and off by TR9 so that the operation of the optical device can be self tested during normal operation.

4.2.15 Transmission Disengaged Detection

A micro switch is mounted on the transmission carriage to detect when the transmission drive has been disengaged.

The signal from the microswitch changes state when the declutch levers are activated. This signal is fed via IC16 to an input port on the microcontroller.

4.2.16 Audible Alarm Drive

The audible alarm is located on the Power Supply PCB, the microcontroller alarm signal is fed to PL6.

4.2.17 Visual Indicator Drives

The start and stop LEDs are located on the display PCB but are driven through output port, IC15.

4.2.18 Keypad Read

The keypad is located on the display PCB and is arranged in an X-Y matrix. The keypad is polled by sequentially taking the keypad columns low and testing the state of the keypad rows determine which button is activated.

The keypad columns are driven through the output expansion port, IC15, via the data bus and the keypad rows are read directly into the microcontroller via input pins.

4.2.19 LCD Display Drive

The LCD display is located on the display PCB; data is passed using the data bus to a graphics controller located on the display PCB which is memory mapped into the microcontroller address space. The decoded address of the graphics controller is selected using IC7-10 which activates the controller chip enable input.

4.2.20 Syringe Size Measurement

A linear potentiometer mounted in the upper case detects the movement of the syringe clamp shaft. The linear potentiometer is configured as a potential divider and produces a signal relative to the syringe diameter. The signal from the potentiometer passes through a unity gain amplifier IC10. The output from the amplifier is fed into the one of the ADC inputs of the microcontroller.

4.2.21 Interfaces

The dual serial interface signals, respiration alarm input and nurse call alarm output are fed to the interface connector PL7. Pull up resistors are fitted to the RX inputs so that if no interface board is fitted the inputs to the microcontroller are held high.

4.2.22 CCFL Power Supply Inverter

The display CCFL lamp is supplied by a switched mode inverter power supply on the control PCB.

The main controller for the supply is IC8 which generates a pulse output on pin 7; this pulls current via inductor L2 which in the Royer configuration inverter establishes an oscillating current in the transformer L1 primary. The transformer is a large turns ratio step up device which produces about 250V ac on its output pins. The output is ac coupled before connection to the lamp. The lamp current is monitored via R73 and fed back to IC8 so closing the feedback loop. The supply operates to control the lamp current at about 5mA. When the display backlight is to dim a bias voltage created by R71 and R72 offsets the feedback signal to IC8 so reducing the regulated lamp current.

The supply operates over the full mains unregulated supply and internal battery voltages, fed via MVCC. The supply to IC8 is fed via a low current 5V regulator IC16. The output IC16 correctly maintains the supply to IC8 at least a volt or so below MVCC even at low supply input voltages (even when the output of IC16 no longer maintains 5V).

The CCFL lamp power supply consumes several watts of power (reduced when the lamp is dimmed).

Because of the high output voltage of this circuit care should be taken to avoid touching it.

4.3 Display PCB

The Display PCB is located in the upper case assy of the pump. The display board module is generally supplied as a complete module for the purposes of maintenance and repair; however the backlight fluorescent lamp can be replaced on its own.

All connections between the Display PCB and the Control PCB are via connectors PL2 and PL4.

4.3.1 LCD Display Drivers

The 240 x 64 pixel graphics LCD panel is driven by four display drivers, IC3, IC5, IC6 and IC7.

4.3.2 LCD Graphics Controller And VRAM

The LCD display is setup by the control PCB microcontroller which access a memory mapped graphics controller, IC1 on the display PCB. The graphics controller stores a bitwise mapping of the display in a video RAM chip IC2.

4.3.3 LCD Bias Voltages

The four display drivers require a variety of negative bias voltages V1..V5. These are created by a switching converter IC4.

4.3.4 Visual Indicators

The start led, stop led, AC power led and battery led are driven from signals supplied from the control PCB. Resistors R10, R11 and R12 limit the current through leds D1, D2 and D3 respectively. The AC power led is driven directly from the power supply PCB via connections on the control PCB.

4.3.5 Keypad

The keypad is made up of up to 10 individual mechanical switches and is arranged in an X-Y matrix. The keypad is polled from the control PCB by sequentially taking the keypad columns low and testing the state of the keypad rows to determine which button is activated.

Diodes in the keypad matrix decouple the rows and columns to prevent false switch decoding if more than one switch is held down at a time.

4.3.6 Cold Cathode Fluorescent Lamp (CCFL) Backlight

The LCD panel is backlit by a CCFL lamp. The lamp is mounted along one edge of the display board and a light guide behind the transmissive LCD panel lights up the display. The backlight power supply is driven from the control PCB. The supply is a high voltage ac waveform which is controlled to setup a 5mA (approx) current in the lamp. The lamp current is regulated on the control PCB so as to maintain an even brightness over the normal variation in mains and internal battery supply voltages.

4.4 Flexible Circuit

Refer to Wiring Diagram Drg. No. 5000EL00042 in section 5.

Two flexible circuits are used to make all the interconnections to the transmission components located in the upper case assembly.

All connections between the flexible circuit and the control PCB are made via PL1.

4.4.1 Motor Optical Encoders

Two slotted optical switches are mounted on the back of the motor/gearbox assembly to detect the speed of rotation.

The optical switches are activated by a flag mounted on the rear output shaft of the motor.

4.4.2 End of Infusion Optical Switch

A slotted optical switch is mounted on the transmission motor plate to detect a near end of infusion. It is activated by a flag which is mounted on the transmission carriage.

4.4.3 Linear Speed Optical Switch

A slotted optical switch is mounted on the transmission carriage and is used in conjunction with a slotted grid to monitor the linear travel of the unit.

4.4.4 Transmission Disengaged Microswitch

A micro switch, SW1, is mounted on the transmission carriage to detect when the transmission drive has been disengaged.

4.4.5 Plunger Detect Optical Switch

A slotted optical switch is mounted inside the syringe plunger holder body and is used in conjunction with a cruciform actuator, in turn connected to the plunger detection button. The optical switch detects when a syringe plunger is correctly located in the plunger holder.

4.5 Dual RS232/Nursecall/Respiration Alarm Interface PCB

The interface PCB is located in the lower case assembly of the pump under a cover on the base of the syringe pump.

Refer to the circuit diagram, component location drawing and parts list in section 5.

4.5.1 Printer/Smart Card Interface

The printer/smart card RS232 interface is isolated to 4kV. The interface allows data to be sent to a printer or smart card from the control PCB microcontroller. IC1 drives an isolation power transformer T1, and opto couplers OP1 and OP2. The isolated supply is created by IC2, MAX251, which interfaces to the RS232 voltage levels of about +/-10V. Signals from the printer or smart card are fed back via optos OP3 and OP4.

4.5.2 RS232 Communication Interface

An isolated circuit similar to the one described above forms the general communication RS232 interface, using IC3 and IC4. Only two data signals are passed across the isolation barrier via OP5 and OP6.

4.5.3 Respiration Alarm Input

An alarm input is provided on the interface board to allow a respiration monitor to shut down PCA via the microcontroller software. If the NALM input, pin 1, is pulled low by connection to pin 5 of the interface connector PL1 a current is established in the opto OP7. The opto output then switches and can be monitored by the control PCB microcontroller.

4.5.4 Nurse Call Interface

The nurse call interface provides a potential free, normally open, contact via relay RL1.

The relay contacts can switch 1 amp at up to 30V dc; the contacts are isolated from the coil to 4kV.

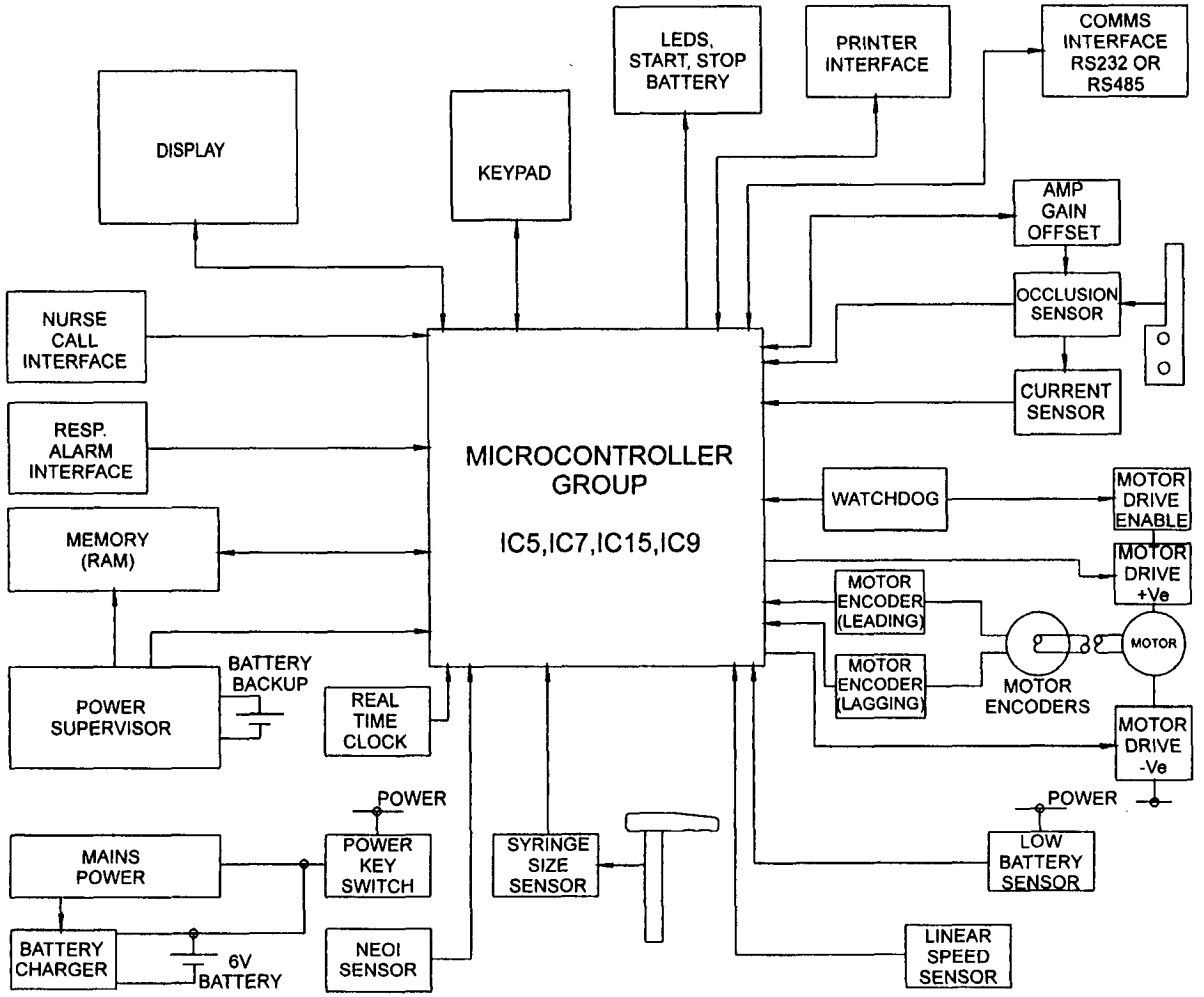
RL1 is energised by transistors TR1 and TR2 which are driven from the nurse call alarm signal from the control PCB. TR2 provides the necessary pull-in current for RL1 and is subsequently turned off after the time set by R3, R7 and C5 in order to reduce current consumption. TR1 provides the holding current for RL1.

Note that the nurse call alarm signal can be disabled in the microcontroller software so that the relay coil remains unenergised so conserving power if the nurse call feature is not required.

5.0 ELECTRICAL SCHEMATICS, COMPONENT LOCATIONS, AND PARTS LISTS

5.1 Electrical Block Diagram:

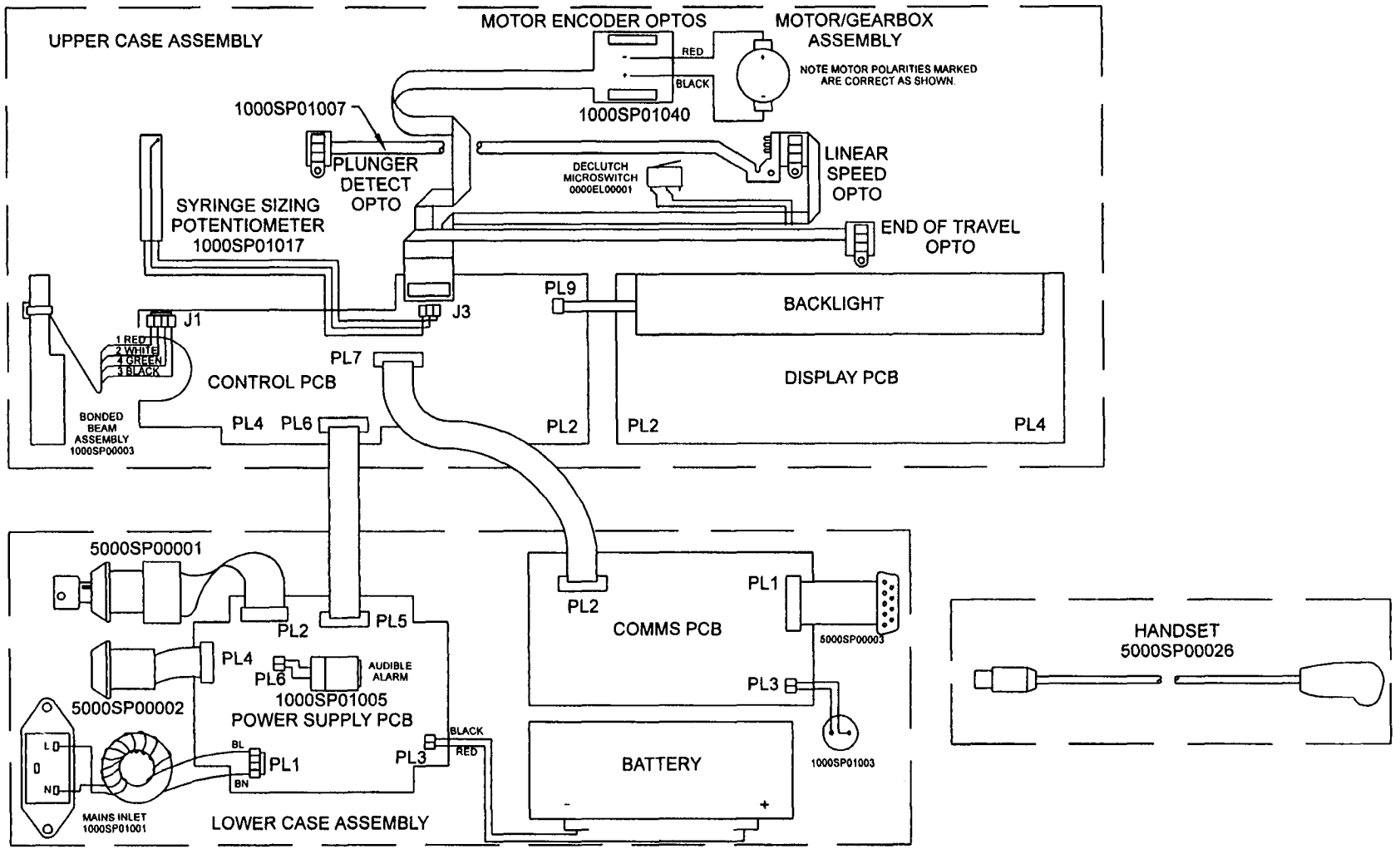
5000EL00053 Block Diagram (not issue controlled)
See next sheet.



Electrical Block Diagram
(not issue controlled) 5000EL00053

5.2 Wiring Diagram:

5000EL00042 Block Diagram (not issue controlled)
See next sheet.



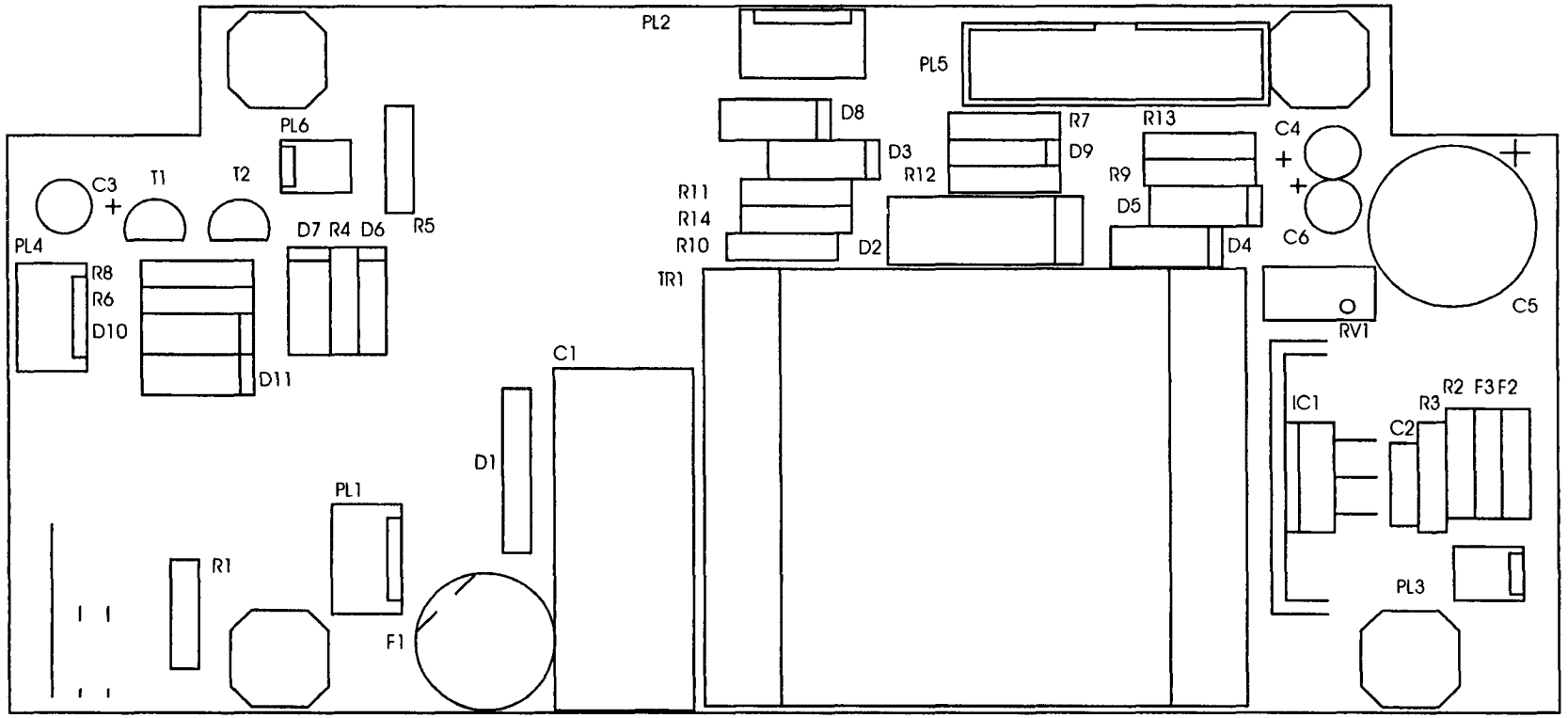
Wiring Diagram
(not issue controlled) 5000EL00042

5.3 Power Supply Board (MK 1):

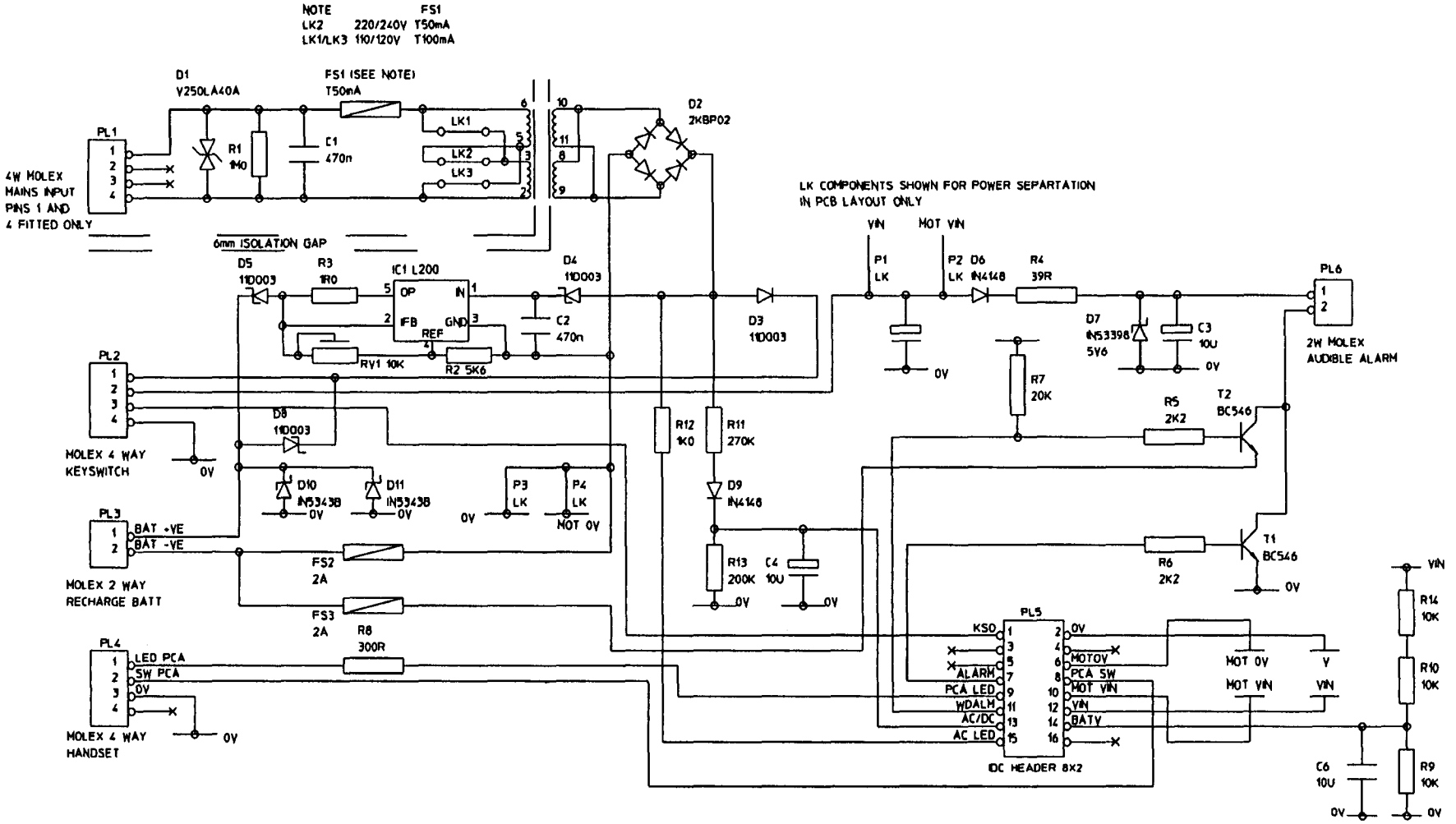
5000EL00014	Component Location	(not issue controlled)
5000EL00002	PSU Schematic	(not issue controlled)
5000EL00038	BOM 240/220v Board	(MK1) (not issue controlled)
5000EL00039	BOM 120/110v Board	(MK1) (not issue controlled)

Mark 1 Power Board superseded at build issue 45. Mark 2 Power Board started from build issue 46.

See next sheets.



5000EL00014 Component Location
(not issue controlled)



5000EL00002 Power Board Schematic (not issue controlled)

Item Number: 5000EL00038 ASSY PCB PSU 240V P5000 Iss: 9

Part Number	Reference	Description	Qty
5000PR00001		SCHEDULE TEST P5000	1.0
5000EL00011	1	OUTLINE PSU P5000	1.0
0000ME00015	2	WASHER M3 WAVEY SST	1.0
0000ME00292	3	NUT M3 A2 STAINLESS STEE L	1.0
0000EL00024	5	HEATSINK	1.0
0000ME00228	6	SCREW M3x20 PAN HD POSI 1 ZP+P	2.0
0000ME00221	7	SCREW M3x6 PAN HD POSI ZP+P	3.0
0000ME00126	8	SPACER M3x9.53 HEX NYLON	2.0
0000ME00044	9	WASHER M3 NYLON	2.0
0000EL00031	C1	CAPACITOR 470n 250V AC X2	1.0
0000EL00077	C2	CAPACITOR 470n 50 V CERAMIC	1.0
0000EL00054	C3,4,6	CAPACITOR 10u 16V TANT	3.0
0000EL00266	C5	CAPACITOR 3300uF 16V ELECTROLYTIC 25	1.0
0000EL00018	D1	SUPPRESSOR V250LA40A	1.0
0000EL00162	D10,11	DIODE 1N5343B ZENER 7V5	2.0
0000EL00014	D2	RECTIFIER BRIDGE 2KBP02	1.0
0000EL00017	D3,4,5,8	DIODE 11DQ03	4.0
0000EL00016	D6,9	DIODE IN4148	2.0
0000EL00161	D7	DIODE 1N5339B ZENER 5V6	1.0
0000EL00026	F1	HOLDER FUSE 20MM VERTICAL	1.0
0000EL00284	F2,3	LINK FUSE 2A PICOFUSE	2.0
0000EL00287	FS1	FUSE 63mA 20mm A/S ANTI-SURGE	1.0
0000EL00023	IC1	REGULATOR L200	1.0
0000EL00100	LINK 1	CABLE BLACK 7/0.2	0.1
0000EL00012	PL1,2,4	CONNECTOR PLUG 4 WAY MOLEX	3.0
0000EL00013	PL3,6	CONNECTOR PLUG 2 WAY MOLEX	2.0
0000EL00011	PL5	CONNECTOR PLUG 16 WAY HEADER	1.0
0000EL00043	R1	RESISTOR 1M0 0.5W 1%	1.0
0000EL00041	R11	RESISTOR 270K 0.25W 1%	1.0
0000EL00037	R12	RESISTOR 1K0 0.25W 1%	1.0
0000EL00038	R13	RESISTOR 200K 0.25W 1%	1.0
0000EL00034	R2	RESISTOR 5K6 0.25W 1%	1.0
0000EL00033	R3	RESISTOR 1R0 0.25W 1%	1.0
0000EL00256	R4	RESISTOR 39R 0.25W 1%	1.0
0000EL00036	R5,6	RESISTOR 2K2 0.25W 1%	2.0
0000EL00040	R7	RESISTOR 20K 0.25W 1%	1.0
0000EL00160	R8	RESISTOR 220R 0.25W 1%	1.0
0000EL00255	R9,10,14	RESISTOR 10K 0.125W 0.1% METAL FILM	3.0
0000EL00044	RV1	POTENTIOMETER 10K 25 TURNS	1.0
0000ME00115	SP1,2,3,4	SPACER 4.8mm SELF RETAINING	4.0
0000EL00306	TR1	TRANSFORMER 7.5V 8VA A0807/HF	1.0
0000EL00019	TR1,2	TRANSISTOR BC546	2.0

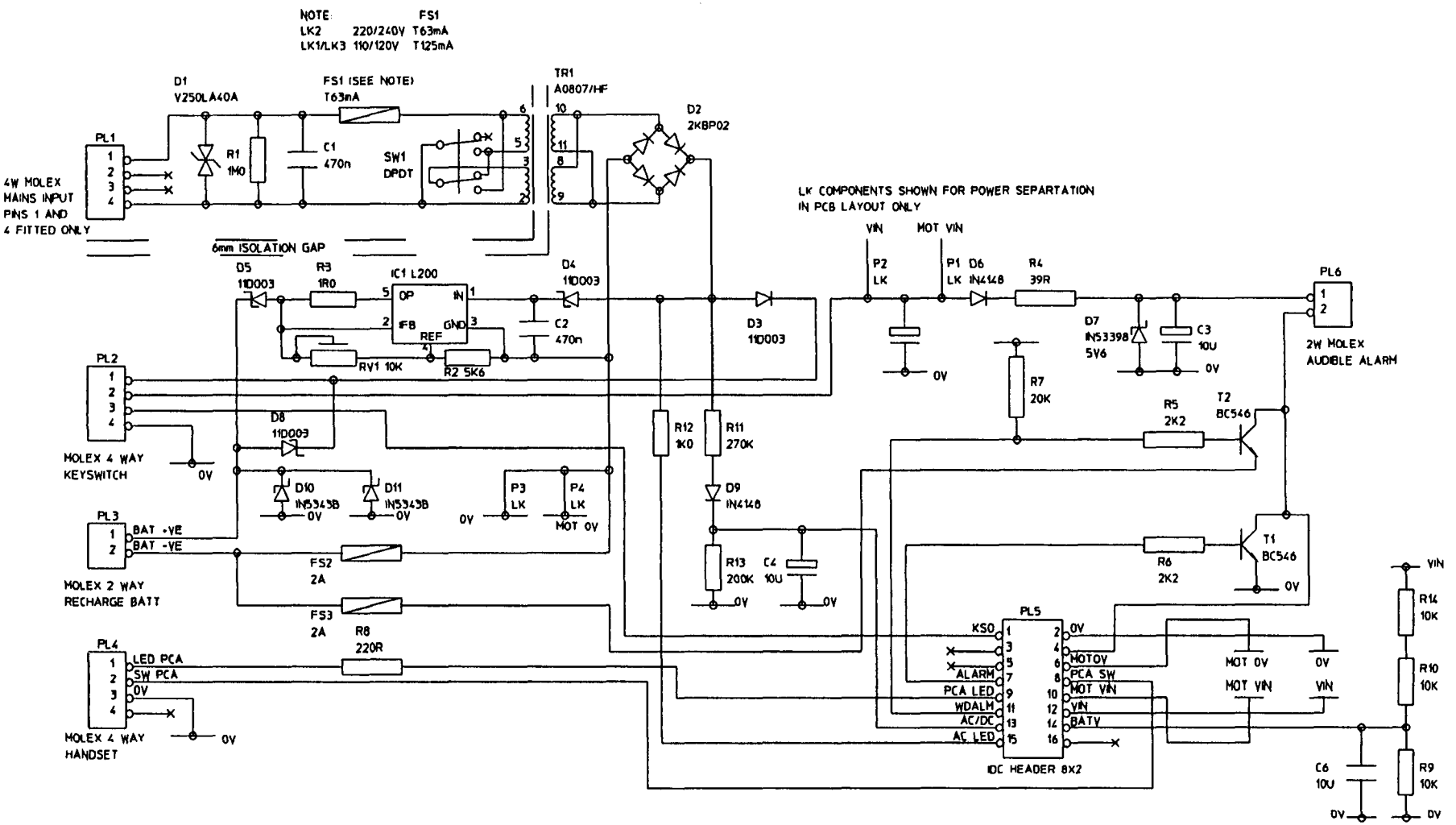
Item Number: 5000EL00039 ASSY PCB PSU 110V Iss: 6

Part Number	Reference	Description	Qty
0000EL00100		CABLE BLACK 7/0.2	0.1
0000EL00287		FUSE 63mA 20mm A/S ANTI-SURGE	-1.0
0000EL00288		FUSE 125mA 20mm A/S ANTI-SURGE	1.0
5000EL00038		ASSY PCB PSU 240V P5000	1.0
5000PB00039		FIT INSTR P5000 PSU VOLTAGE CONVERSION	1.0

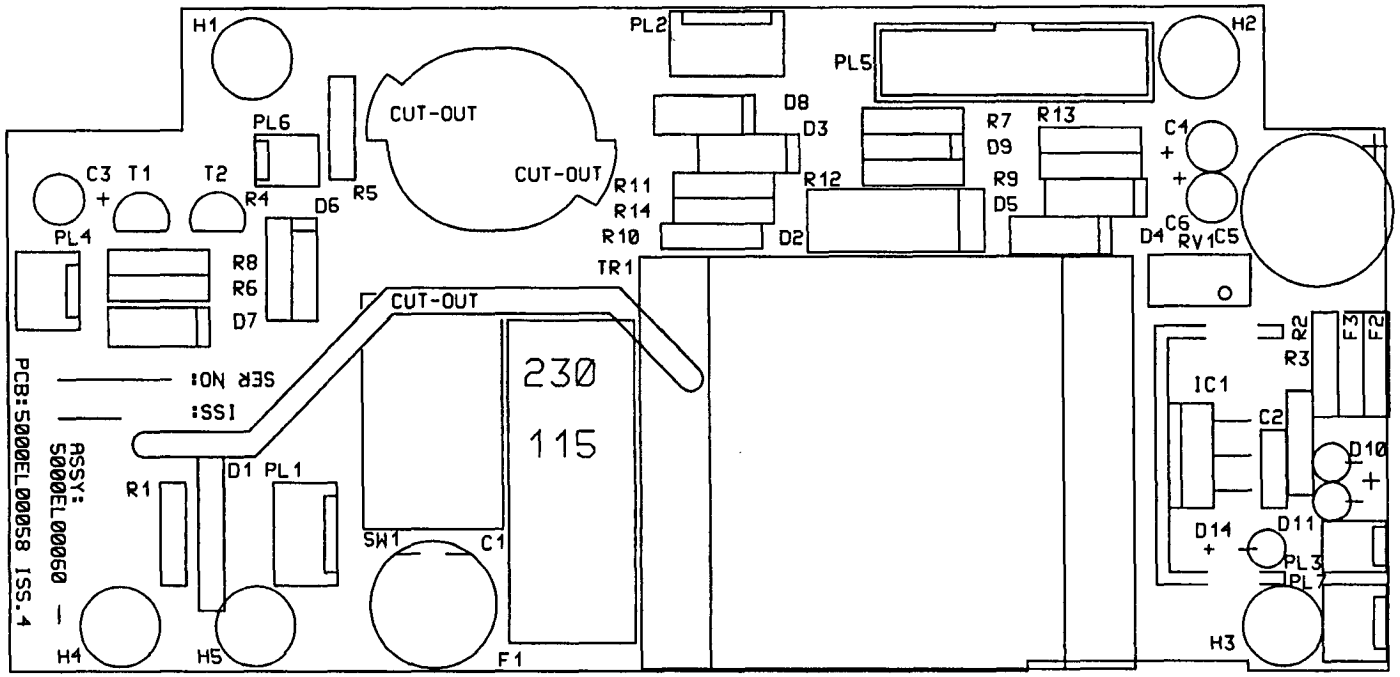
5.3 Power Supply Board (MK 2):

5000EL00059	PSU Schematic	(not issue controlled)
5000EL00058	PSU Component Location	(not issue controlled)
5000EL00060	BOM 240/220v Board	(MK2) (not issue controlled)
5000EL00061	BOM 120/110v Board	(MK2) (not issue controlled)

See next sheets.



5000EL00059 Power Board Schematic
(not issue controlled)



5000EL00058 Component Location
(not issued controlled)

Item Number: 5000EL00060 ASSY PCB PSU 230V P5 (2) Iss: 8

Assembly Notes:

1. CUT OFF THE CORNER FROM TR1, CORNER CLOSEST TO PL3, IC1AND FIXING SCREW.
2. RECORD THE ISSUE IN THE BOX ON THE PCB IDENT.
3. ENSURE THAT SWITCH IS IN POSITION 240. ADD ITEM 4 ACROSS THE 240V INDICATOR.
4. ALL COMPONENT LEADS TO BE CROPPED TO WITHIN 1mm OF THE BOARD UNLESS OTHERWISE STATED.
5. FIT C2 + TO PIN 1 OF IC1.
6. CORNERS OF THE TRANSFORMER MUST BE TRIMMED TO WITHIN 1mm OF THE BODY OF THE TRANSFORMER AND LEAVE NO SHARP EDGES.

Part Number	Reference	Description	Qty
5000PR00001		SCHEDULE TEST P5000	1.0
5000EL00059		SCHEMATIC P5000 PSU PCB	1.0
5000EL00058	1	OUTLINE PSU P5 (2)	1.0
0000ME00015	2	WASHER M3 WAVEY SST	1.0
0000ME00292	3	NUT M3 A2 STAINLESS STEE L	1.0
0000ME00235	4	LABEL 240V SELF ADHESIVE	1.0
0000EL00024	5	HEATSINK	1.0
0000ME00228	6	SCREW M3x20 PAN HD POSI 1 ZP+P	2.0
0000ME00221	7	SCREW M3x6 PAN HD POSI ZP+P	3.0
0000ME00126	8	SPACER M3x9.53 HEX NYLON	2.0
0000ME00044	9	WASHER M3 NYLON	2.0
0000EL00031	C1	CAPACITOR 470n 250V AC X2	1.0
0000EL00054	C2	CAPACITOR 10u 16V TANT	1.0
0000EL00054	C3,4,6	CAPACITOR 10u 16V TANT	3.0
0000EL00266	C5	CAPACITOR 3300uF 16V ELECTROLYTIC 25	1.0
0000EL00018	D1	SUPPRESSOR V250LA40A	1.0
0000EL00162	D10,11	DIODE 1N5343B ZENER 7V5	2.0
0000EL00014	D2	RECTIFIER BRIDGE 2KBP02	1.0
0000EL00017	D3,4,5,8	DIODE 11DQ03	4.0
0000EL00016	D6,9	DIODE IN4148	2.0
0000EL00161	D7	DIODE 1N5339B ZENER 5V6	1.0
0000EL00026	F1	HOLDER FUSE 20MM VERTICAL	1.0
0000EL00284	F2,3	LINK FUSE 2A PICOFUSE	2.0
0000EL00287	FS1	FUSE 63mA 20mm A/S ANTI-SURGE	1.0
0000EL00023	IC1	REGULATOR L200	1.0
0000EL00100	LINK 1	CABLE BLACK 7/0.2	0.1
0000EL00012	PL1,2	CONNECTOR PLUG 4 WAY MOLEX	2.0
0000EL00013	PL3,6	CONNECTOR PLUG 2 WAY MOLEX	2.0
0000EL00131	PL4	CONNECTOR PLUG 3 WAY MOLEX	1.0
0000EL00011	PL5	CONNECTOR PLUG 16 WAY HEADER	1.0
0000EL00043	R1	RESISTOR 1M0 0.5W 1%	1.0
0000EL00041	R11	RESISTOR 270K 0.25W 1%	1.0
0000EL00037	R12	RESISTOR 1K0 0.25W 1%	1.0
0000EL00038	R13	RESISTOR 200K 0.25W 1%	1.0
0000EL00034	R2	RESISTOR 5K6 0.25W 1%	1.0
0000EL00033	R3	RESISTOR 1R0 0.25W 1%	1.0
0000EL00256	R4	RESISTOR 39R 0.25W 1%	1.0
0000EL00036	R5,6	RESISTOR 2K2 0.25W 1%	2.0
0000EL00040	R7	RESISTOR 20K 0.25W 1%	1.0
0000EL00160	R8	RESISTOR 220R 0.25W 1%	1.0
0000EL00255	R9,10,14	RESISTOR 10K 0.125W 0.1% METAL FILM	3.0
0000EL00044	RV1	POTENTIOMETER 10K 25 TURNS	1.0
0000ME00115	SP1,2,3,4	SPACER 4.8mm SELF RETAINING	4.0
0000EL00351	SW1	SWITCH SLIDE 115/230V ARCOELECTRIC X2225C	1.0
0000EL00306	TR1	TRANSFORMER 7.5V 8VA A0807/HF	1.0
0000EL00019	TR1,2	TRANSISTOR BC546	2.0

Item Number: 5000EL00061 ASSY PCB PSU 115V P5 (2) Iss: 5

Assembly Notes:

1. REPLACE FUSE IN 5000EL00060 AND ENSURE SWITCH IS IN POSITION 115.
2. ALL COMPONENT LEAD TO BE CROPPED TO WITHIN 1mm OF THE BOARD UNLESS OTHERWISE STATED.
3. REMOVE ITEM 4 LABEL 240V 0000ME00235.
4. CORNERS OF THE TRANSFORMER MUST BE TRIMMED TO WITHIN 1mm OF THE BODY OF THE TRANSFORMER AND LEAVE NO SHARP EDGES.

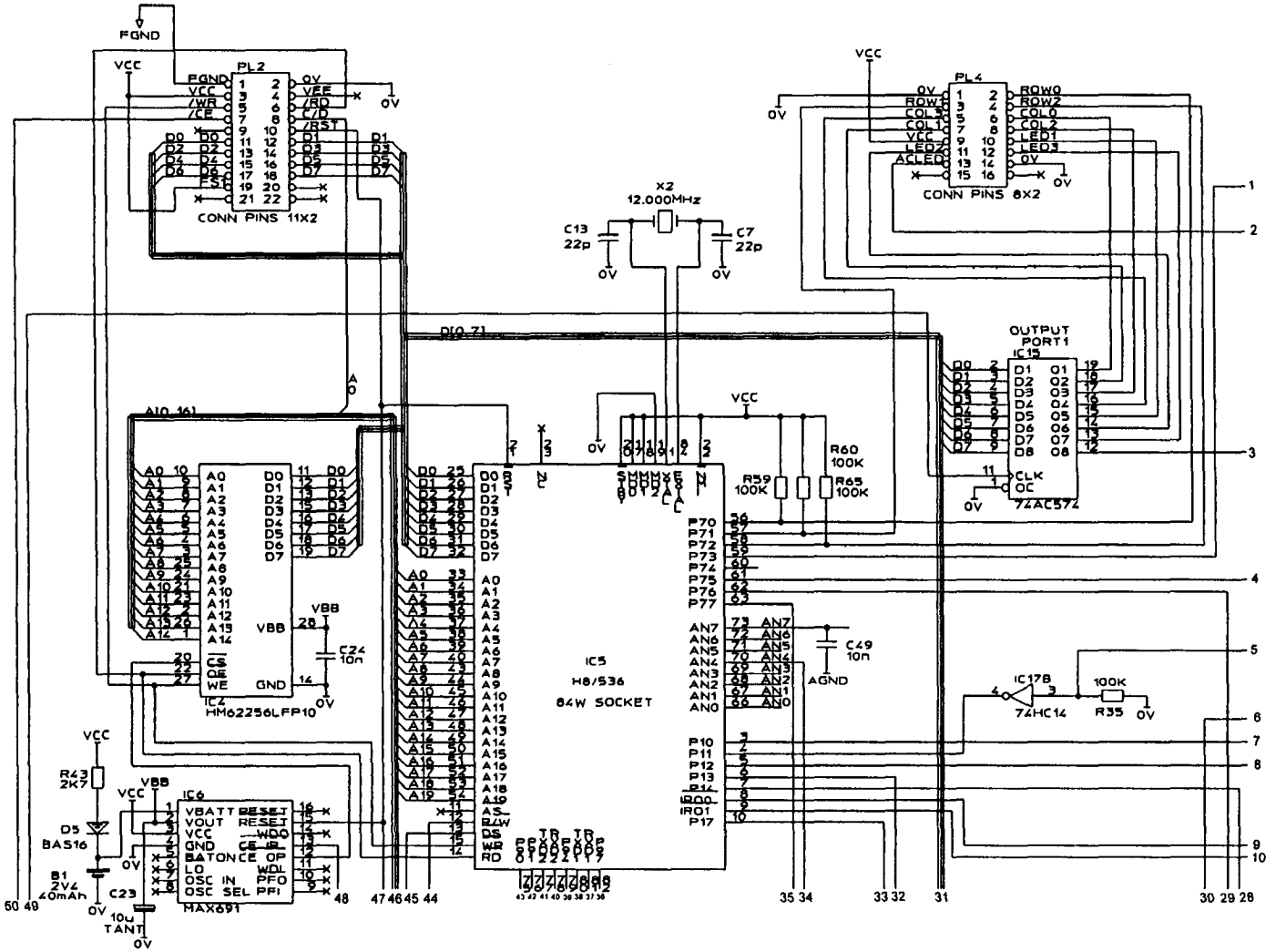
Part Number	Reference	Description	Qty
0000EL00287		FUSE 63mA 20mm A/S	-1.0
0000EL00288		FUSE 125mA 20mm A/S	1.0
5000EL00060		ASSY PCB PSU 230V P5 (2)	1.0

5.4 Control Board (mark 1):

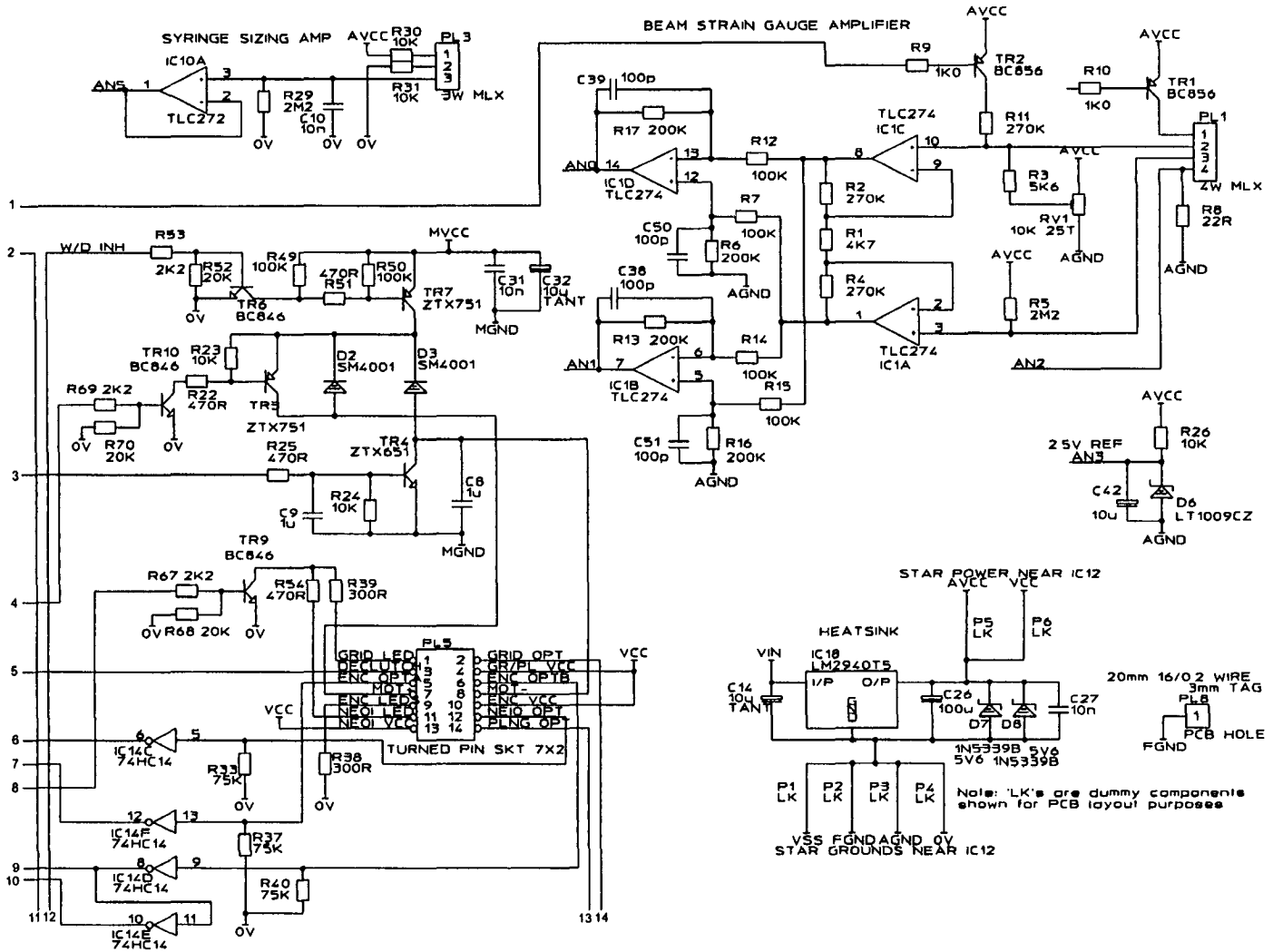
5000EL00004	Component Location	(not issue controlled)
5000EL00001	Control Board Schematic	(not issue controlled)
5000EL00010	Control BOM	(not issue controlled)

Mark 1 has same Component Location Board as Mark 2.

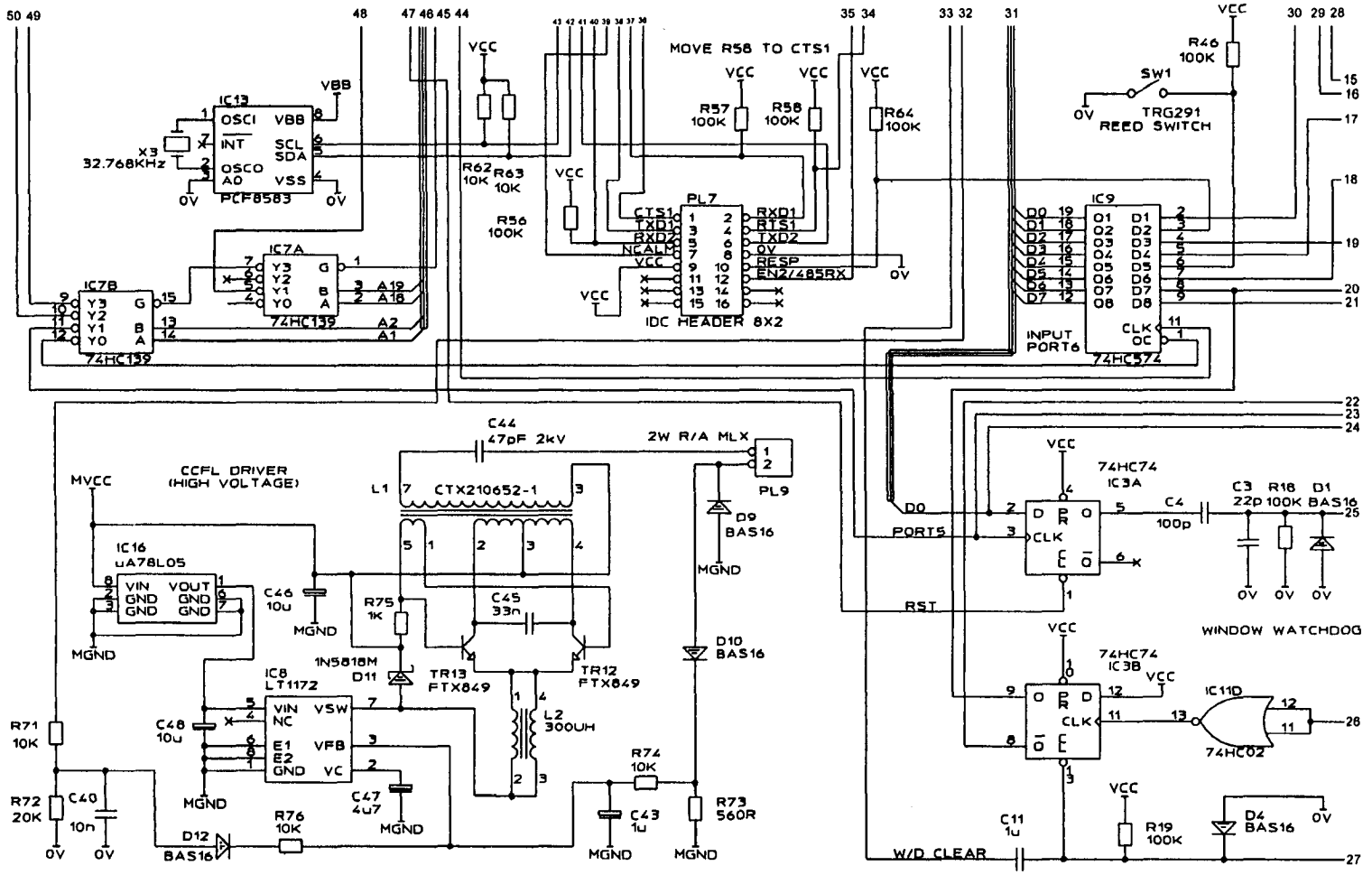
See next sheets.



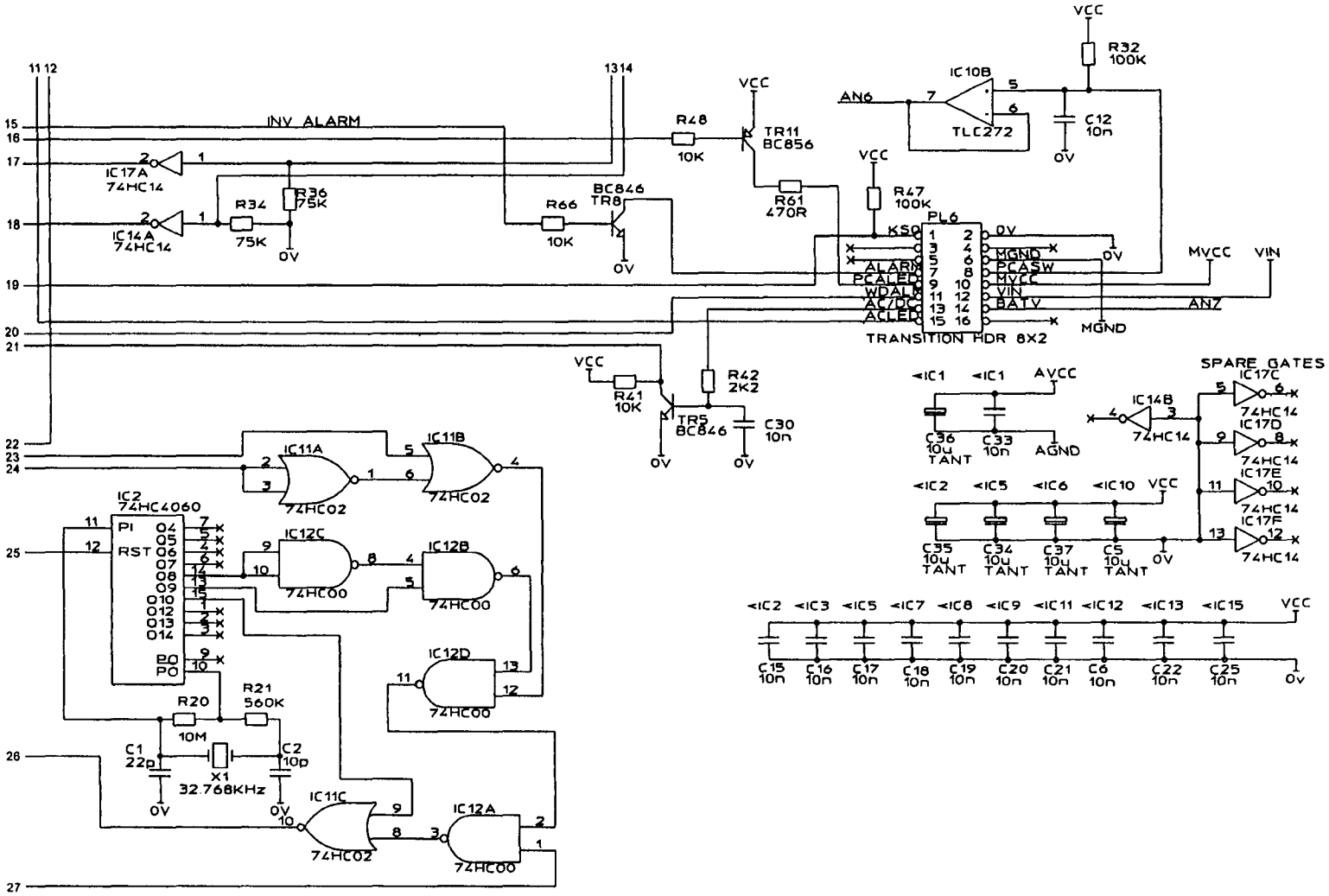
5000EL00001 Control Board Schematic
(not issue controlled)



5000EL00001 Control Board Schematic
(not issue controlled)



5000EL00001 Control Board Schematic
(not issue controlled)



5000EL00001 Control Board Schematic
(not issue controlled)

Item Number: 5000EL00010 ASSY PCB CONTROL PCAM Iss: 5

Assembly Notes:

1. FIT Y1+Y3 FLAT ON PCB,HAND SOLDER THE END OF CAN TO SECURE IT TO THE PCB.
2. FIT B1,PL2,PL4,PL6,SW1 AND ITEM 1 AS POST ASSEMBLY OPERATIONS.
3. FIT PL2+PL4 ON THE NON COMP SIDE OF BOARD. ORIENATE THE CONNECTORS SO PLASTIC BODY IS TIGHT AGAINST THE SURFACE OF THE PCB.
4. FIT PL6 TRANSITION HEADER WITH THE CABLE RUN OUT OVER THE EDGE OF PCB.
5. CRIMP A LENGHT OF ITEM 3 TO J8, SOLDER THE OTHER END OF THE WIRE TO J8.
6. FIT ITM 1 INTO THE 5 HOLES AROUND THE PCB,FIT FROM NON-COMP SIDE OF BOARD
7. USE ITM5,6,7 TO FIX ITM4 BENEATH IC18. FIT SCREW INTO NON-COMP SIDE OF BOARD, NUT AND WASHER ON TOP OF IC18.ENSURE HEATSINK IS SQUARE TO IS OUTLINE.
8. FIT SW1 TO NON COMP SIDE OF BOARD WITH GLASS BODY IN THE RECESS OF ITM 2. ENSURE THAT CONTACT INSIDE GLASS IS POLARISED AS SHOWN IN IDENT (CONTACT NEAREST THE CORNER OF PCB), THE GLASS BODY IS OFFSET TO THE 'CONTACT' END OFRECESS, SO THE GLASS TOUCHES THE END OF THE RECESS.
9. PROGRAM BLANK EPROM IC20 WITH LATEST S/W AS SUPPLIED TO CREATE IC20-PROG, FIT INTO SKT-IC20. EPROM MUST BE APPROPRIATELY LABELLED.

Part Number	Reference	Description	Qty
5000PR00005		SCHEDULE TEST CONTROL P5000	0.0
0000EL00208	B1	BATTERY NiCd 2.4V 40mAH	1.0
0000EL00232	C1,3,7,13	CAPACITOR 22p 50v COG 1206	4.0
0000EL00270	C2	CAPACITOR 10p 50V COG 1206	1.0
0000EL00230	C22,24,25,27	CAPACITOR 10n 25V CERAMIC	9.0
0000EL00030	C26	CAPACITOR 100u ELECTR.	1.0
0000EL00233	C4,38,39,50,	CAPACITOR 100p 50V 1206	5.0
0000EL00272	C43	CAPACITOR 1u 16v TANT	1.0
0000EL00273	C44	CAPACITOR 47p 2KV CERAMIC	1.0
0000EL00276	C45	CAPACITOR 33n 50v CERAMIC	1.0
0000EL00278	C47	CAPACITOR 4u7 16V TANT C CASE	1.0
0000EL00229	C5,14,23,32,	CAPACITOR 10u 16V TANT C CASE	11.0
0000EL00230	C6,10,12,15,	CAPACITOR 10n 25V CERAMIC	11.0
0000EL00234	C8,9,11	CAPACITOR 1u 16V CERAMIC	3.0
0000EL00235	D1,4,5,9,10,	DIODE BAS16 S/M	6.0
0000EL00274	D11	DIODE IN5818M SCHOTTKY BARRIER S/M	1.0
0000EL00236	D6	DIODE GL41 S/M	1.0
0000EL00206	D7,8	DIODE IN5339B 5V6 ZENER	2.0
0000EL00237	D7,8	DIODE LT1009CZ	1.0
0000EL00209	IC1	IC TYPE TLC274ACD QUAD OP AMP - TEXAS SOIC	1.0
0000EL00217	IC10	IC TYPE TLC272CD DUAL OP AMP TEXAS SOIC	1.0
0000EL00218	IC11	IC TYPE 74HC02 QUAD NOR GATE SOIC	1.0
0000EL00219	IC12	IC TYPE 74HC00 QUAD NAND GATES SOIC	1.0
0000EL00220	IC13	IC TYPE PCF8583T RTC CHIP SOIC	1.0
0000EL00221	IC14	IC TYPE 74HC14 SCHMITT INVERTER SOIC	1.0
0000EL00223	IC15	IC TYPE 74AC574D 8 BIT LATCH SOIC	1.0
0000EL00222	IC15-ALTERN'	IC TYPE 74AC574N 8 BIT LATCH	0.0
0000EL00221	IC17	IC TYPE 74HC14 SCHMITT INVERTER SOIC	1.0
0000EL00224	IC18	IC TYPE LM2940CT-5.0 REGULATOR	1.0
0000EL00269	IC19	IC TYPE 78L05 VOLTAGE REGULATOR	1.0
0000EL00210	IC2	IC TYPE MC14060B CMOS COUNTER MOTOROLA SOIC	1.0
0000EL00211	IC3	IC TYPE 74HC74 DUAL LATCH SOIC	1.0
0000EL00212	IC4	IC TYPE HM62256BLFP-10T RAM 32Kx8 SOIC	1.0
0000EL00083	IC5	CONNECTOR SOCKET IC 28 WAY	1.0
0000EL00214	IC6	IC TYPE MAX691A MICRO SUPERVISOR MAXIM SOIC	1.0
0000EL00264	IC7	IC TYPE 74HC139 DUAL 2 TO 4 DECODER SOIC	1.0
0000EL00268	IC8	IC TYPE LT1172 SWITCHING REGULATOR S/M	1.0
0000EL00216	IC9	IC TYPE 74HC574 8 BIT LATCH S/M	1.0
0000ME00115	ITM1	SPACER 4.8mm SELF RETAINING	5.0
5000ME00069	ITM2	SPACER REED SWITCH	1.0
0000EL00182	ITM3	CABLE BLACK 16/0.2	0.1
0000EL00261	ITM4	HEATSINK P5 PSU	1.0
0000ME00070	ITM5	SCREW M3x8 PAN HD SLOTTE D	1.0
0000ME00292	ITM6	NUT M3 A2 STAINLESS STEE L	1.0
0000ME00015	ITM7	WASHER M3 WAVEY SST	1.0
0000EL00012	J1	CONNECTOR PLUG 4 WAY MOLEX	1.0
0000EL00131	J3	CONNECTOR PLUG 3 WAY MOLEX	1.0
0000EL00189	J8	TERMINAL CRIMP INSULATED RING	1.0
0000EL00279	L1	COIL CTX210652-1	1.0
0000EL00280	L2	INDUCTOR 300uH CTX300-4	1.0
5000EL00005	PCB	OUTLINE CONTROL P5000	1.0
0000EL00262	PL2	CONNECTOR PLUG 22 WAY (SAMTEC BDL-111-T-E)	1.0
0000EL00228	PL4	CONNECTOR PLUG 16 WAY (SAMTEC SDL-107-TT-11)	1.0
0000EL00104	PL5	CONNECTOR SOCKET 14 WAY	1.0
0000EL00123	PL6	ASSY CABLE RIBBON 16 WAY	1.0
0000EL00011	PL7	CONNECTOR PLUG 16 WAY HEADER	1.0
0000EL00147	PL9	CONNECTOR PLUG 2 WAY R/A MOLEX	1.0
0000EL00239	R1	RESISTOR 4K7 0.25W 2%	1.0
0000EL00240	R2,4,11	RESISTOR 270K 0.25W 2%	3.0
0000EL00231	R20	RESISTOR 10M 0.125W	1.0
0000EL00271	R21	RESISTOR 560K 0.25W 2%	1.0
0000EL00247	R22,25,51,54	RESISTOR 470R 0.25W	4.0
0000EL00248	R23,24,26,30	RESISTOR 10K 0.25	13.0

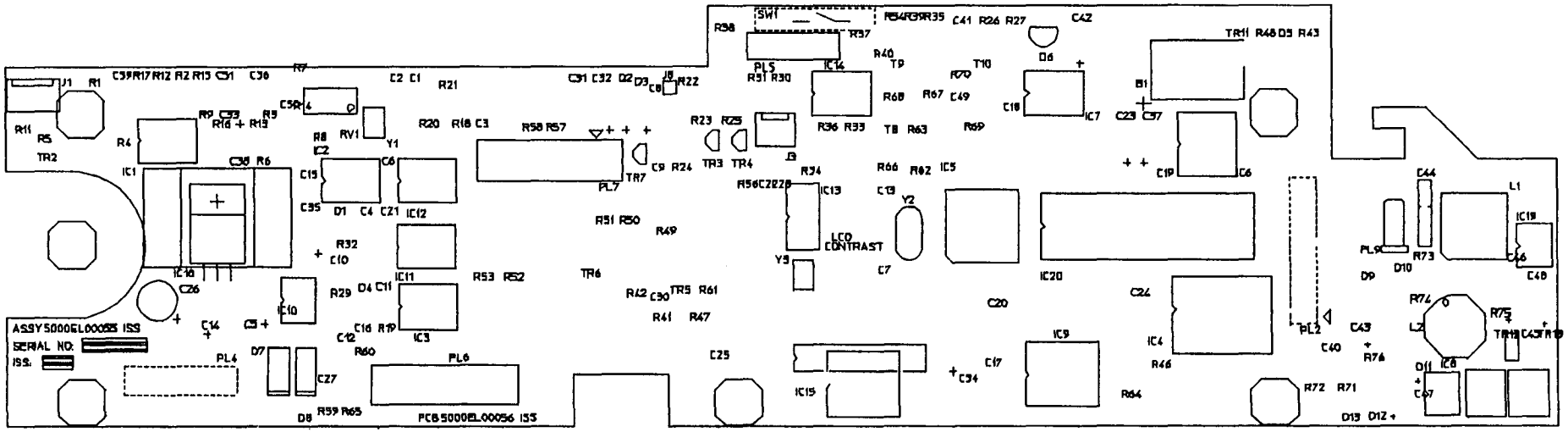
Item Number: 5000EL00010 ASSY PCB CONTROL PCAM Iss: 5

Part Number	Reference	Description	Qty
0000EL00241	R3	RESISTOR 5K6 0.25W 2%	1.0
0000EL00249	R33,34,36,37	RESISTOR 75K 0.25W	5.0
0000EL00250	R38,39	RESISTOR 300R 0.25W	2.0
0000EL00251	R42,53,67,69	RESISTOR 2K2 0.25W	4.0
0000EL00252	R43	RESISTOR 2K7 0.25W	1.0
0000EL00244	R49,50,56,57	RESISTOR 100K 0.25W 2%	9.0
0000EL00242	R5,29	RESISTOR 2M2 0.125W	2.0
0000EL00253	R52,68,70,72	RESISTOR 20K 0.25W	4.0
0000EL00243	R6,13,16,17,	RESISTOR 200K 0.25W 2%	6.0
0000EL00311	R61	RESISTOR 0R CRG1206	1.0
0000EL00244	R7,12,14,15,	RESISTOR 100K 0.25W 2%	10.0
0000EL00271	R73	RESISTOR 560K 0.25W 2%	1.0
0000EL00245	R8	RESISTOR 22R 0.25W 2%	1.0
0000EL00246	R9,10,75	RESISTOR 1K0 0.25W	3.0
0000EL00238	RV1	POTENTIOMETER 10K 25 TURNS 0.5W	1.0
0000EL00281	SW1	SWITCH REED FR TRG291	1.0
0000EL00225	TR1,2,11	TRANSISTOR BC856 PNP S/M	3.0
0000EL00277	TR12,13	TRANSISTOR ZTX849 NPN ZETEX	2.0
0000EL00021	TR3,7	TRANSISTOR FZT 751 SOT22 3	2.0
0000EL00067	TR4	TRANSISTOR ZTX651 SOT223	1.0
0000EL00226	TR5,6,8,9,10	TRANSISTOR BC846 NPN S/M	5.0
0000EL00128	Y1,3	CRYSTAL 32.768KHZ WATCH	2.0
0000EL00227	Y2	CRYSTAL 12.000MHZ HC49/4U	1.0

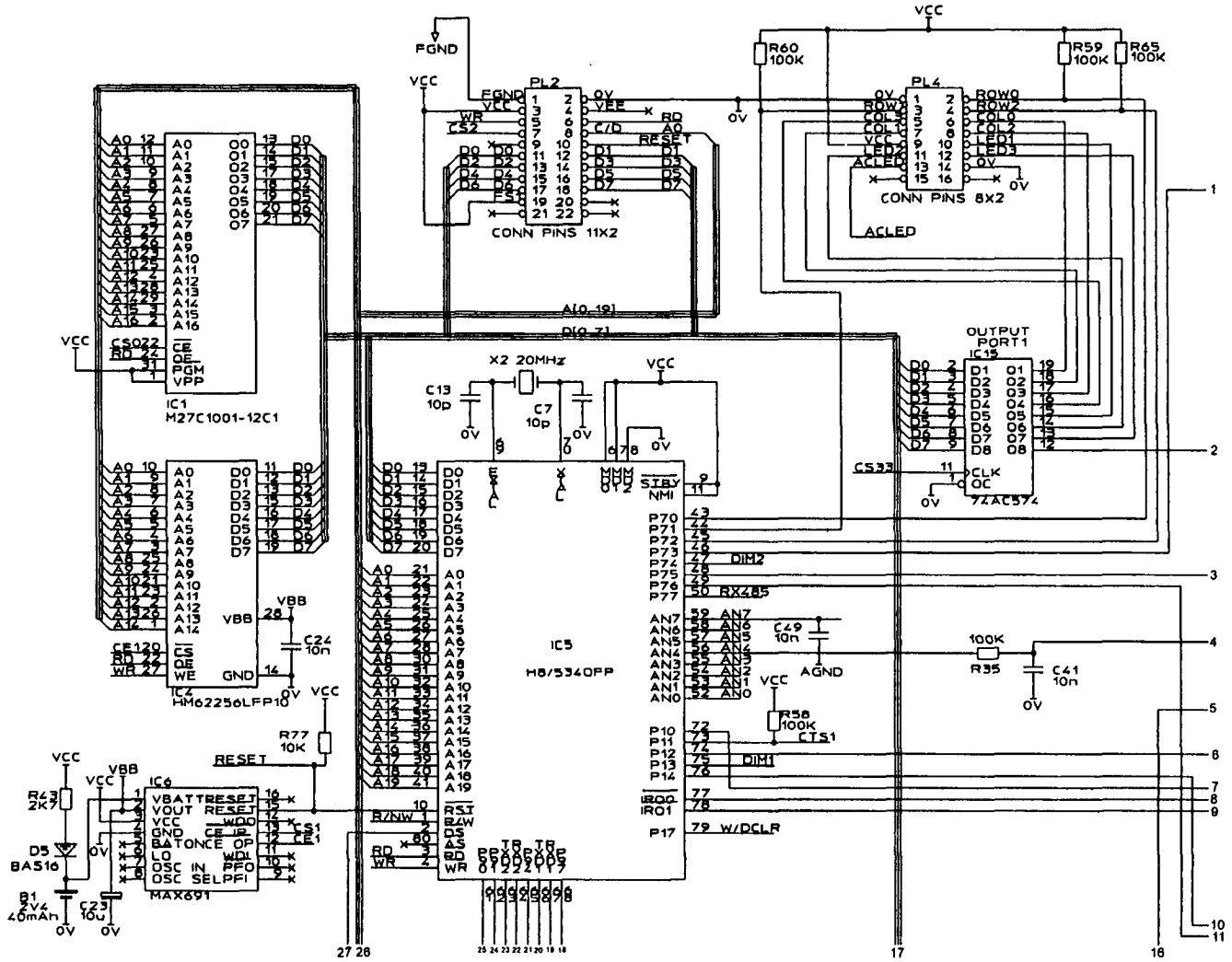
5.4 Control Board (mark 2):

5000EL00056	Component Location	(not issue controlled)
5000EL00054	Control Board Schematic	(not issue controlled)
5000EL00055	Control BOM	(not issue controlled)

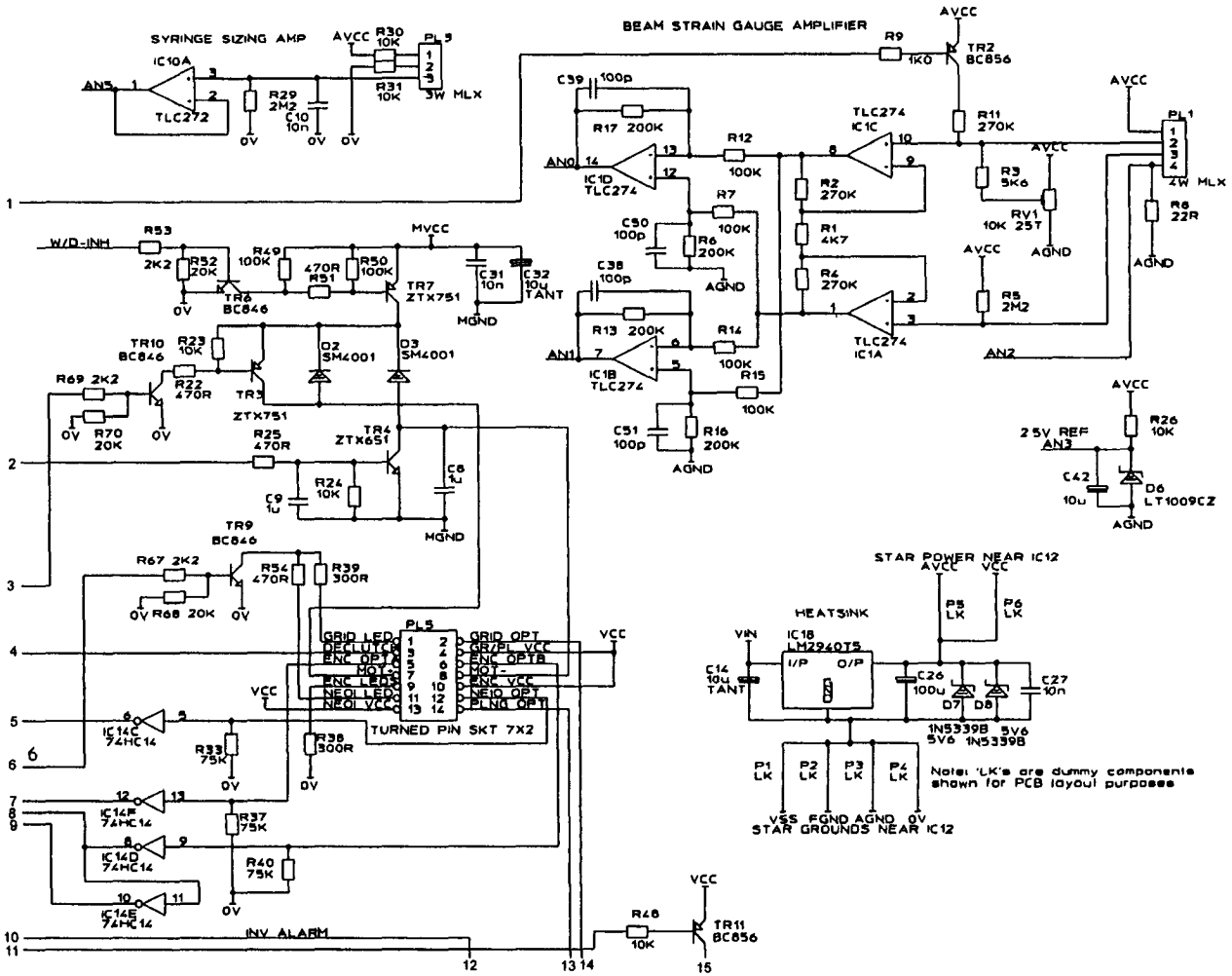
See next sheets.



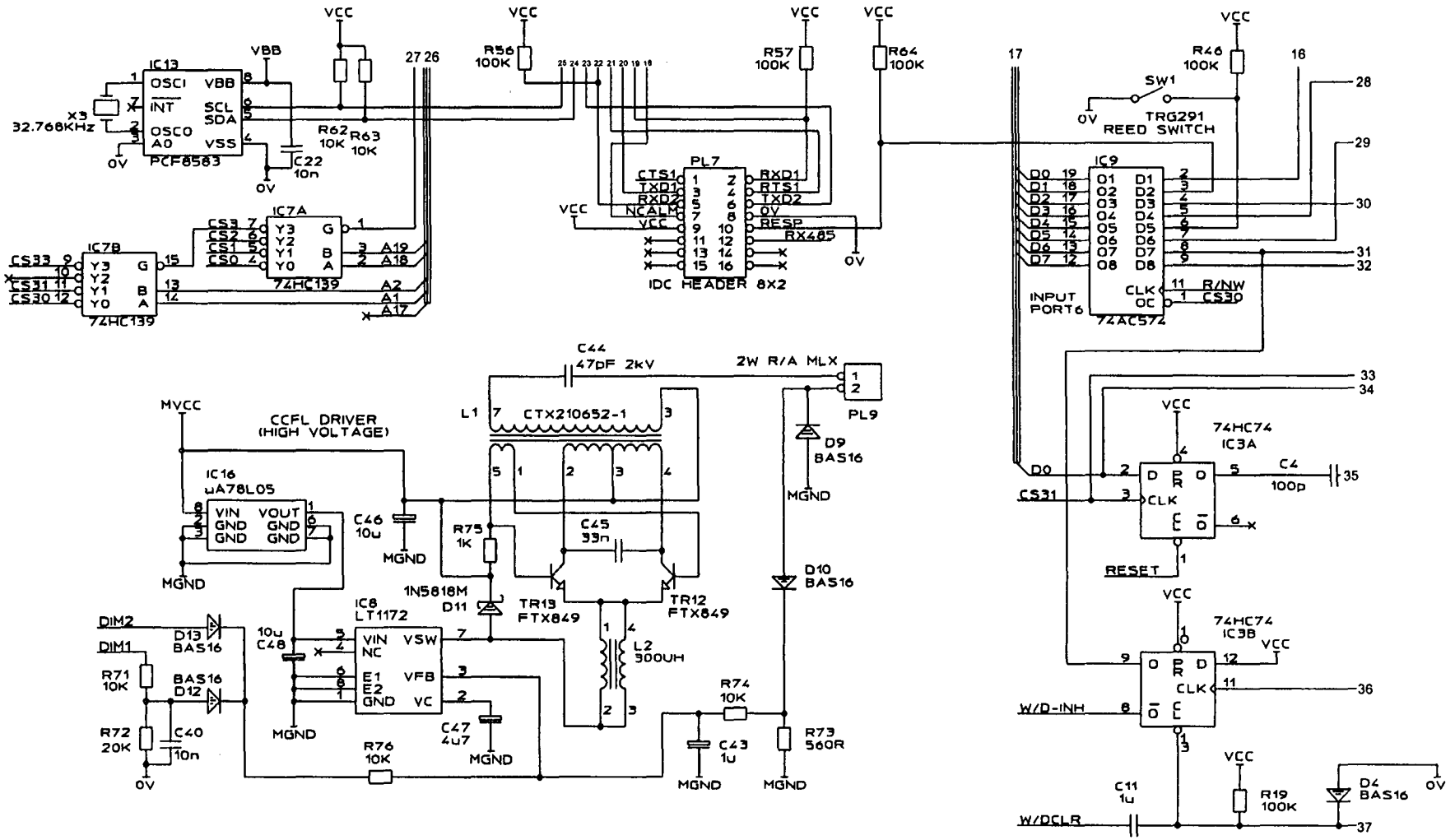
5000EL00056 Control Board
Component Location (not issue controlled)



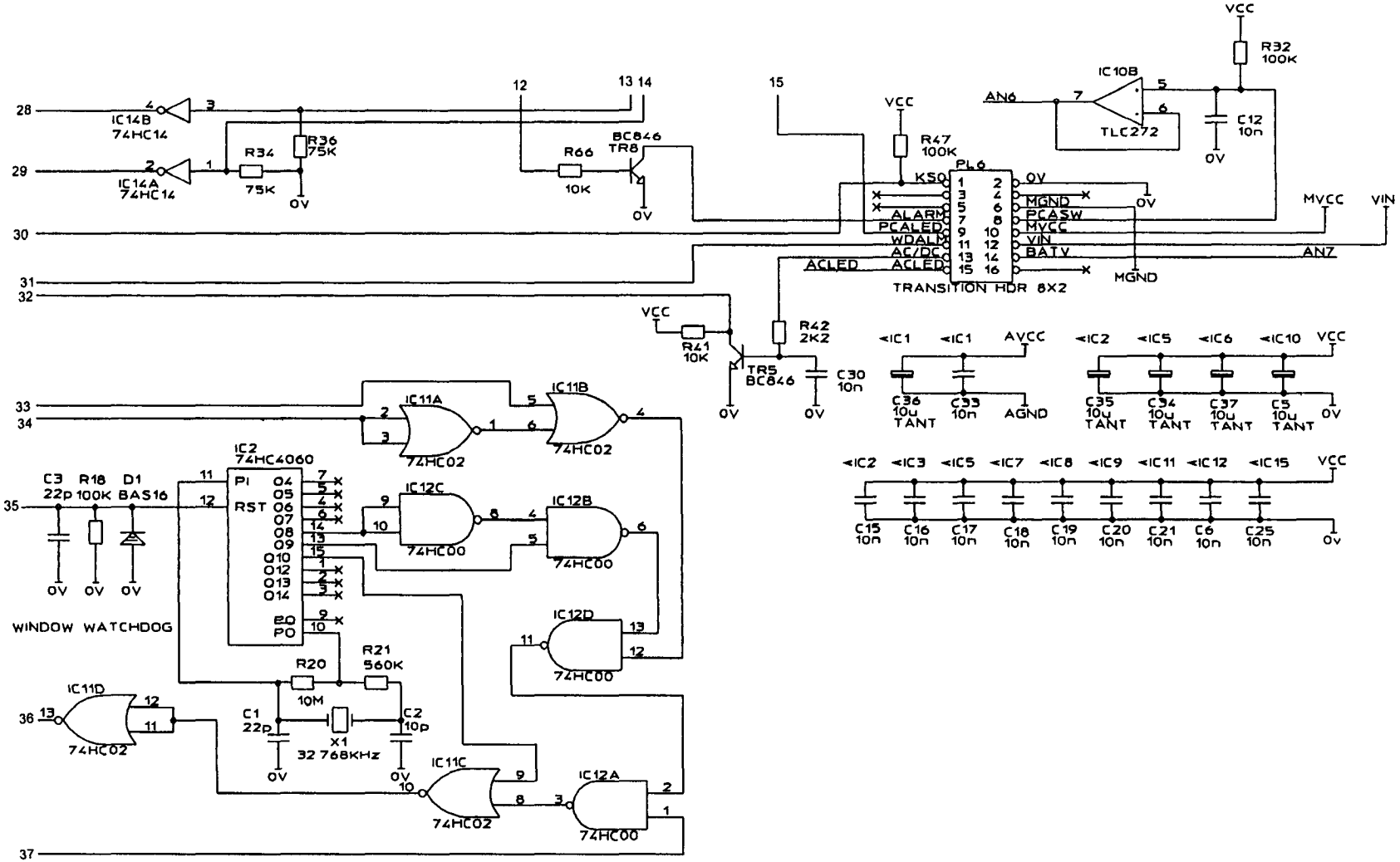
5000EL00054 Control Board Schematic
(not issue controlled)



5000EL00054 Control Board Schematic
(not issue controlled)



5000EL00054 Control Board Schematic
(not issue controlled)



5000EL00054 Control Board Schematic
(not issue controlled)

Item Number: 5000EL00055 ASSY PCB CONTROL PCAM Iss: 7

Assembly Notes:

1. FIT Y1+Y3 FLAT ON PCB,HAND SOLDER THE END OF CAN TO SECURE IT TO THE PCB.
2. FIT B1,PL2,PL4,PL6,SW1 AND ITEM 1 AS POST ASSEMBLY OPERATIONS.
3. FIT PL2+PL4 ON THE NON COMP SIDE OF BOARD. ORIENATE THE CONNECTORS SO PLASTIC BODY IS TIGHT AGAINST THE SURFACE OF THE PCB.
4. FIT PL6 TRANSITION HEADER WITH THE CABLE RUN OUT OVER THE EDGE OF PCB.
5. CRIMP A LENGTH OF ITEM 3 TO J8, SOLDER THE OTHER END OF THE WIRE TO J8.
6. FIT ITM 1 INTO THE 5 HOLES AROUND THE PCB,FIT FROM NON-COMP SIDE OF BOARD
7. USE ITM5,6,7 TO FIX ITM4 BENEATH IC18. FIT SCREW INTO NON-COMP SIDE OF BOARD,NUT AND WASHER ON TOP OF IC18. ENSURE HEATSINK IS SQUARE TO IS OUTLINE.
8. FIT SW1 TO NON COMP SIDE OF BOARD WITH GLASS BODY IN THE RECESS OF ITM 2. ENSURE THAT CONTACT INSIDE GLASS IS POLARISED AS SHOWN IN IDENT (CONTACT NEAREST THE CORNER OF PCB), THE GLASS BODY IS OFFSET TO THE 'CONTACT' END OF RECESS, SO THE GLASS TOUCHES THE END OF THE RECESS.
9. PROGRAM BLANK EPROM IC20 WITH LATEST S/W AS SUPPLIED TO CREATE IC20-PROG, FIT INTO SKT-IC20. EPROM MUST BE APPROPRIATELY LABELLED.
10. FIT ITM8 OVER THE LEAD OF R77 TO PREVENT SORTING. R77 TO BE FITTED BETWEEN PIN 3 AND 10 OF PL2.

Part Number	Reference	Description	Qty
5000PR00005		SCHEDULE TEST CONTROL P5000	1.0
0000ME00053		PAD SELF ADHESIVE DOUBLE SIDED	1.0
0000EL00208	B1	BATTERY NiCd 2.4V 40mAH	1.0
0000EL00232	C1,3,28	CAPACITOR 22p 50v COG 1206	3.0
0000EL00230	C16,17,18,19	CAPACITOR 10n 25V CERAMIC	4.0
0000EL00270	C2,7,13	CAPACITOR 10p 50V COG 1206	3.0
0000EL00230	C20,21,22,24	CAPACITOR 10n 25V CERAMIC	4.0
0000EL00230	C25,27,30,31	CAPACITOR 10n 25V CERAMIC	4.0
0000EL00030	C26	CAPACITOR 100u ELECTR.	1.0
0000EL00230	C33,40,41,49	CAPACITOR 10n 25V CERAMIC	4.0
0000EL00229	C34,35,36,42	CAPACITOR 10u 16V TANT C CASE	4.0
0000EL00233	C4,38,39,50	CAPACITOR 100p 50V 1206	4.0
0000EL00272	C43	CAPACITOR 1u 16v TANT	1.0
0000EL00273	C44	CAPACITOR 47p 2KV CERAMIC	1.0
0000EL00276	C45	CAPACITOR 33n 50v CERAMIC	1.0
0000EL00229	C46,48	CAPACITOR 10u 16V TANT C CASE	2.0
0000EL00278	C47	CAPACITOR 4u7 16V TANT C CASE	1.0
0000EL00229	C5,14,23,32	CAPACITOR 10u 16V TANT C CASE	4.0
0000EL00233	C51	CAPACITOR 100p 50V 1206	1.0
0000EL00230	C6,10,12,15	CAPACITOR 10n 25V CERAMIC	4.0
0000EL00234	C8,9,11	CAPACITOR 1u 16V CERAMIC	3.0
0000EL00235	D1,4,5,9,10,	DIODE BAS16 S/M	5.0
0000EL00274	D11	DIODE IN5818M SCHOTTKY BARRIER S/M	1.0
0000EL00235	D12,13	DIODE BAS16 S/M	2.0
0000EL00236	D2,3	DIODE GL41 S/M	2.0
0000EL00237	D6	DIODE LT1009CZ	1.0
0000EL00206	D7,8	DIODE IN5339B 5V6 ZENER	2.0
0000EL00209	IC1	IC TYPE TLC274ACD QUAD OP AMP - TEXAS SOIC	1.0
0000EL00217	IC10	IC TYPE TLC272CD DUAL OP AMP TEXAS SOIC	1.0
0000EL00218	IC11	IC TYPE 74HC02 QUAD NOR GATE SOIC	1.0
0000EL00219	IC12	IC TYPE 74HC00 QUAD NAND GATES SOIC	1.0
0000EL00220	IC13	IC TYPE PCF8583T RTC CHIP SOIC	1.0
0000EL00221	IC14	IC TYPE 74HC14 SCHMITT INVERTER SOIC	1.0
0000EL00223	IC15	IC TYPE 74AC574D 8 BIT LATCH SOIC	1.0
0000EL00222	IC15 ALTER	IC TYPE 74AC574N 8 BIT LATCH	0.0
0000EL00224	IC18	IC TYPE LM2940CT-5.0 REGULATOR	1.0
0000EL00269	IC19	IC TYPE 78L05 VOLTAGE REGULATOR	1.0
0000EL00210	IC2	IC TYPE MC14060B CMOS COUNTER MOTOROLA SOIC	1.0
0000EL00314	IC20	IC TYPE EPROM M27C1001-1 2F1 120nS DIP	1.0
5000EL00057	IC20-PROG	EPROM PROGRAM P5000	0.0
0000EL00211	IC3	IC TYPE 74HC74 DUAL LATCH SOIC	1.0
0000EL00212	IC4	IC TYPE HM62256BLFP-10T RAM 32Kx8 SOIC	1.0
0000EL00313	IC5	IC TYPE H8/534 ROMLESS 10MHZ QFP80A HITACHI	1.0
0000EL00214	IC6	IC TYPE MAX691A MICRO SUPERVISOR MAXIM SOIC	1.0
0000EL00264	IC7	IC TYPE 74HC139 DUAL 2 TO 4 DECODER SOIC	1.0
0000EL00268	IC8	IC TYPE LT1172 SWITCHING REGULATOR S/M	1.0
0000EL00216	IC9	IC TYPE 74HC574 8 BIT LATCH S/M	1.0
0000ME00115	ITM1	SPACER 4.8mm SELF RETAINING	5.0
5000ME00065	ITM2	SPACER REED SWITCH	1.0
0000EL00182	ITM3	CABLE BLACK 16/0.2	0.1
0000EL00261	ITM4	HEATSINK P5 PSU	1.0
0000ME00231	ITM5	SCREW M3x8 PAN HD POSI ZP+P	1.0
0000ME00015	ITM7	WASHER M3 WAVEY SST	1.0
0000EL00451	ITM8	SLEEVING PTFE 0.71 DIA	0.1
0000EL00012	J1	CONNECTOR PLUG 4 WAY MOLEX	1.0
0000EL00131	J3	CONNECTOR PLUG 3 WAY MOLEX	1.0
0000EL00189	J8	TERMINAL CRIMP INSULATED RING	1.0
0000EL00279	L1	COIL CTX210652-1	1.0
0000EL00280	L2	INDUCTOR 300uH CTX300-4	1.0
5000EL00056	PCB	OUTLINE CONTROL DRG	1.0

Item Number: 5000EL00055 ASSY PCB CONTROL PCAM Iss: 7

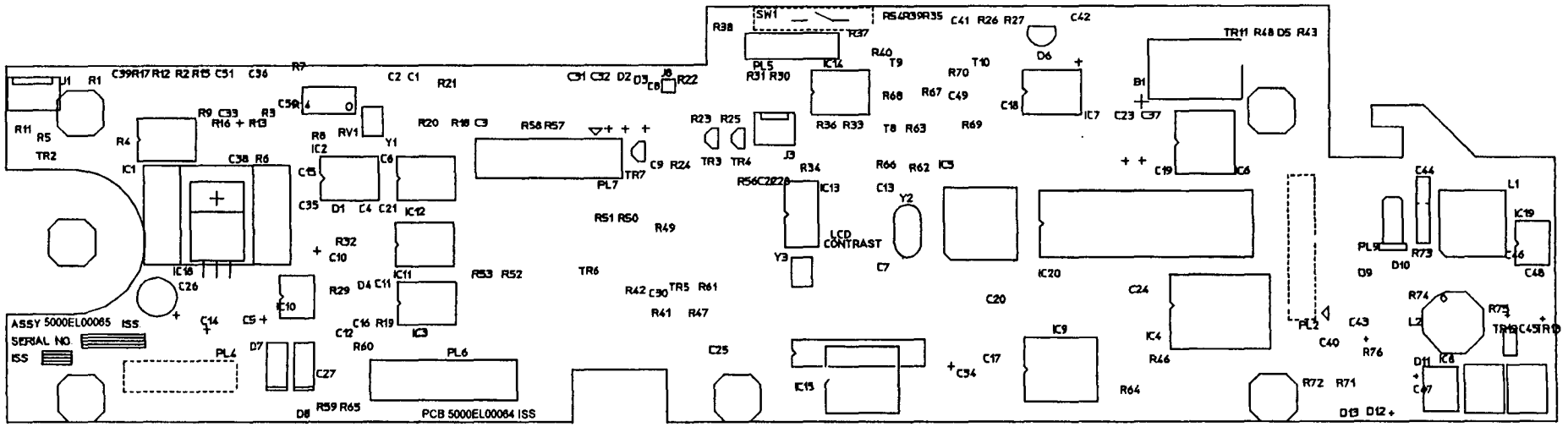
Part Number	Reference	Description	Qty
0000EL00262	PL2	CONNECTOR PLUG 22 WAY (SAMTEC BDL-111-T-E)	1.0
0000EL00228	PL4	CONNECTOR PLUG 16 WAY (SAMTEC SDL-107-TT-11)	1.0
0000EL00104	PL5	CONNECTOR SOCKET 14 WAY	1.0
1000EL00135	PL6	ASSY CABLE 16 WAY RIBBON	1.0
0000EL00011	PL7	CONNECTOR PLUG 16 WAY HEADER	1.0
0000EL00147	PL9	CONNECTOR PLUG 2 WAY R/A MOLEX	1.0
0000EL00239	R1	RESISTOR 4K7 0.25W 2%	1.0
0000EL00244	R18,19,27,32	RESISTOR 100K 0.25W 2%	4.0
0000EL00240	R2,4,11	RESISTOR 270K 0.25W 2%	3.0
0000EL00231	R20	RESISTOR 10M 0.125W	1.0
0000EL00271	R21	RESISTOR 560K 0.25W 2%	1.0
0000EL00247	R22,25,51,54	RESISTOR 470R 0.25W	4.0
0000EL00248	R23,24,26,30	RESISTOR 10K 0.25	4.0
0000EL00241	R3	RESISTOR 5K6 0.25W 2%	1.0
0000EL00248	R31,41,48,62	RESISTOR 10K 0.25	4.0
0000EL00249	R33,34,36,37	RESISTOR 75K 0.25W	4.0
0000EL00244	R35,46,47,49	RESISTOR 100K 0.25W 2%	4.0
0000EL00250	R38,39	RESISTOR 300R 0.25W	2.0
0000EL00249	R40	RESISTOR 75K 0.25W	1.0
0000EL00251	R42,53,67,69	RESISTOR 2K2 0.25W	4.0
0000EL00252	R43	RESISTOR 2K7 0.25W	1.0
0000EL00242	R5,29	RESISTOR 2M2 0.125W	2.0
0000EL00244	R50,56,57,58	RESISTOR 100K 0.25W 2%	4.0
0000EL00244	R59,60,64,65	RESISTOR 100K 0.25W 2%	4.0
0000EL00243	R6,13,16,17	RESISTOR 200K 0.25W 2%	4.0
0000EL00248	R63,66,71,74	RESISTOR 10K 0.25	4.0
0000EL00244	R7,12,14,15	RESISTOR 100K 0.25W 2%	4.0
0000EL00271	R73	RESISTOR 560K 0.25W 2%	1.0
0000EL00248	R76	RESISTOR 10K 0.25	1.0
0000EL00042	R77	RESISTOR 10K 0.25W 1%	1.0
0000EL00245	R8	RESISTOR 22R 0.25W 2%	1.0
0000EL00246	R9,75	RESISTOR 1K0 0.25W	2.0
0000EL00044	RV1	POTENTIOMETER 10K 25 TURNS	1.0
0000EL00450	SKT-IC20	IC SOCKET 32W-DIL TURNED PIN	1.0
1000EL00141	SW1	SWITCH REED FR TRG291 P5	1.0
0000EL00277	TR12,13	TRANSISTOR ZTX849 NPN ZETEX	2.0
0000EL00225	TR2,11	TRANSISTOR BC856 PNP S/M	2.0
0000EL00021	TR3,7	TRANSISTOR FZT 751 SOT22 3	2.0
0000EL00067	TR4	TRANSISTOR ZTX651 SOT223	1.0
0000EL00226	TR5,6,8,9,10	TRANSISTOR BC846 NPN S/M	5.0
0000EL00128	Y1,3	CRYSTAL 32.768KHZ WATCH	2.0
0000EL00315	Y2	CRYSTAL 20.0MHZ HC49/4U	1.0

5.4 Control Board (mark 3):

5000EL00064	Component Location	(not issue controlled)
5000EL00065	Control BOM	(not issue controlled)

For Schematic Diagram See 5000EL00054 Section 5.4 (Mark 2).

See next sheets.



5000EL00064 Control Board Component Location
(not issue controlled)

Item Number: 5000EL00065 ASSY PCB CONTROL P5000 Iss: 6

Assembly Notes:

1. FIT Y1 AND Y3 WITH SELF ADHESIVE PAD (0000ME00053) UNDERNEATH.
2. FIT B1,PL2,PL4,PL6,SW1 AND ITM 1,3,4,5 AS POST ASSEMBLY OPERATIONS.
3. FIT PL2,PL4 ON THE NON COMPONENT SIDE OF THE BOARD.
4. FIT PL6 TRANSISTION HEADER WITH THE CABLE RUN OUT OVER THE EDGE OF THE PCB.
5. FIT ITM 1 TO THE 5 HOLES AROUND THE PCB, FIT FROM NON COMPONENT SIDE OF THE PCB.
6. SECURE IC18 WITH ITM3,4 AND 5. FIT THE NUT TO THE COMPONENT SIDE OF THE PCB.
7. FIT SW1 TO THE NON COMPONENT SIDE OF THE PCB WITH THE GLASS BODY IN THE RECESS OF ITM 2. ENSURE THAT CONTACT INSIDE GLASS IS POLARISED AS SHOWN IN IDENT (CONTACT NEAREST THE CORNER OF THE PCB), GLASS BODY IS OFFSET TO THE 'CONTACT' END OF RECESS, SO THE GLASS TOUCHES THE END OF THE RECESS.
8. PROGRAM BLANK EPROM IC20 WITH LATEST S/W AS SUPPLIED TO CREATE IC20-PROG, FIT INTO SKT-IC20. EPROM MUST BE APPROPRIATELY LABELLED.

Part Number	Reference	Description	Qty
5000PR00005		SCHEDULE TEST CONTROL P5000	1.0
0000ME00053		PAD SELF ADHESIVE DOUBLE SIDED	1.0
0000EL00208	B1	BATTERY NiCd 2.4V 40mAH	1.0
0000EL00232	C1,3,28	CAPACITOR 22p 50v COG 1206	3.0
0000EL00230	C16,17,18,19	CAPACITOR 10n 25V CERAMIC	4.0
0000EL00270	C2,7,13	CAPACITOR 10p 50V COG 1206	3.0
0000EL00230	C20,21,22,24	CAPACITOR 10n 25V CERAMIC	4.0
0000EL00230	C25,27,30,31	CAPACITOR 10n 25V CERAMIC	4.0
0000EL00030	C26	CAPACITOR 100u ELECTR.	1.0
0000EL00230	C33,40,41,49	CAPACITOR 10n 25V CERAMIC	4.0
0000EL00229	C34,35,36,42	CAPACITOR 10u 16V TANT C CASE	4.0
0000EL00502	C37	CAPACITOR 10uF SMT3528 16V C CASE	1.0
0000EL00233	C4,38,39,50	CAPACITOR 100p 50V 1206	4.0
0000EL00272	C43	CAPACITOR 1u 16v TANT	1.0
0000EL00273	C44	CAPACITOR 47p 2KV CERAMIC	1.0
0000EL00276	C45	CAPACITOR 33n 50v CERAMIC	1.0
0000EL00229	C46,48	CAPACITOR 10u 16V TANT C CASE	2.0
0000EL00278	C47	CAPACITOR 4u7 16V TANT C CASE	1.0
0000EL00229	C5,14,23,32	CAPACITOR 10u 16V TANT C CASE	4.0
0000EL00233	C51	CAPACITOR 100p 50V 1206	1.0
0000EL00230	C6,10,12,15	CAPACITOR 10n 25V CERAMIC	4.0
0000EL00234	C8,9,11	CAPACITOR 1u 16V CERAMIC	3.0
0000EL00235	D1,4,5,9,10,	DIODE BAS16 S/M	5.0
0000EL00274	D11	DIODE IN5818M SCHOTTKY BARRIER S/M	1.0
0000EL00235	D12,13	DIODE BAS16 S/M	2.0
0000EL00236	D2,3	DIODE GL41 S/M	2.0
0000EL00237	D6	DIODE LT1009CZ	1.0
0000EL00206	D7,8	DIODE IN5339B 5V6 ZENER	2.0
0000EL00209	IC1	IC TYPE TLC274ACD QUAD OP AMP - TEXAS SOIC	1.0
0000EL00217	IC10	IC TYPE TLC272CD DUAL OP AMP TEXAS SOIC	1.0
0000EL00218	IC11	IC TYPE 74HC02 QUAD NOR GATE SOIC	1.0
0000EL00219	IC12	IC TYPE 74HC00 QUAD NAND GATES SOIC	1.0
0000EL00220	IC13	IC TYPE PCF8583T RTC CHIP SOIC	1.0
0000EL00221	IC14	IC TYPE 74HC14 SCHMITT INVERTER SOIC	1.0
0000EL00223	IC15	IC TYPE 74AC574D 8 BIT LATCH SOIC	1.0
0000EL00222	IC15 ALTER	IC TYPE 74AC574N 8 BIT LATCH	0.0
0000EL00224	IC18	IC TYPE LM2940CT-5.0 REGULATOR	1.0
0000EL00269	IC19	IC TYPE 78L05 VOLTAGE REGULATOR	1.0
0000EL00210	IC2	IC TYPE MC1406OB CMOS COUNTER MOTOROLA SOIC	1.0
0000EL00314	IC20	IC TYPE EPROM M27C1001-1 2F1 120nS DIP	1.0
5000EL00057	IC20-PROG	EPROM PROGRAM P5000	0.0
0000EL00211	IC3	IC TYPE 74HC74 DUAL LATCH SOIC	1.0
0000EL00212	IC4	IC TYPE HM62256BLFP-10T RAM 32Kx8 SOIC	1.0
0000EL00313	IC5	IC TYPE H8/534 ROMLESS 10MHZ QFP80A HITACHI	1.0
0000EL00214	IC6	IC TYPE MAX691A MICRO SUPERVISOR MAXIM SOIC	1.0
0000EL00264	IC7	IC TYPE 74HC139 DUAL 2 TO 4 DECODER SOIC	1.0
0000EL00268	IC8	IC TYPE LT1172 SWITCHING REGULATOR S/M	1.0
0000EL00216	IC9	IC TYPE 74HC574 8 BIT LATCH S/M	1.0
0000ME00115	ITM1	SPACER 4.8mm SELF RETAINING	5.0
5000ME00065	ITM2	SPACER REED SWITCH	1.0
0000ME00221	ITM3	SCREW M3x6 PAN HD POSI ZP+P	1.0
0000ME00015	ITM4	WASHER M3 WAVEY SST	1.0
0000ME00292	ITM5	NUT M3 A2 STAINLESS STEE L	0.0
0000EL00012	J1	CONNECTOR PLUG 4 WAY MOLEX	1.0
0000EL00131	J3	CONNECTOR PLUG 3 WAY MOLEX	1.0
0000EL00279	L1	COIL CTX210652-1	1.0
0000EL00280	L2	INDUCTOR 300uH CTX300-4	1.0
5000EL00064	PCB	OUTLINE CONTROL P5	1.0
0000EL00262	PL2	CONNECTOR PLUG 22 WAY (SAMTEC BDL-111-T-E)	1.0
0000EL00228	PL4	CONNECTOR PLUG 16 WAY (SAMTEC SDL-107-TT-11)	1.0
0000EL00104	PL5	CONNECTOR SOCKET 14 WAY	1.0
1000EL00135	PL6	ASSY CABLE 16 WAY RIBBON	1.0
0000EL00011	PL7	CONNECTOR PLUG 16 WAY HEADER	1.0
0000EL00147	PL9	CONNECTOR PLUG 2 WAY R/A MOLEX	1.0
0000EL00239	R1	RESISTOR 4K7 0.25W 2%	1.0
0000EL00244	R18,19,27,32	RESISTOR 100K 0.25W 2%	4.0
0000EL00240	R2,4,11	RESISTOR 270K 0.25W 2%	3.0
0000EL00231	R20	RESISTOR 10M 0.125W	1.0

Item Number: 5000EL00065 ASSY PCB CONTROL P5000 Iss: 6

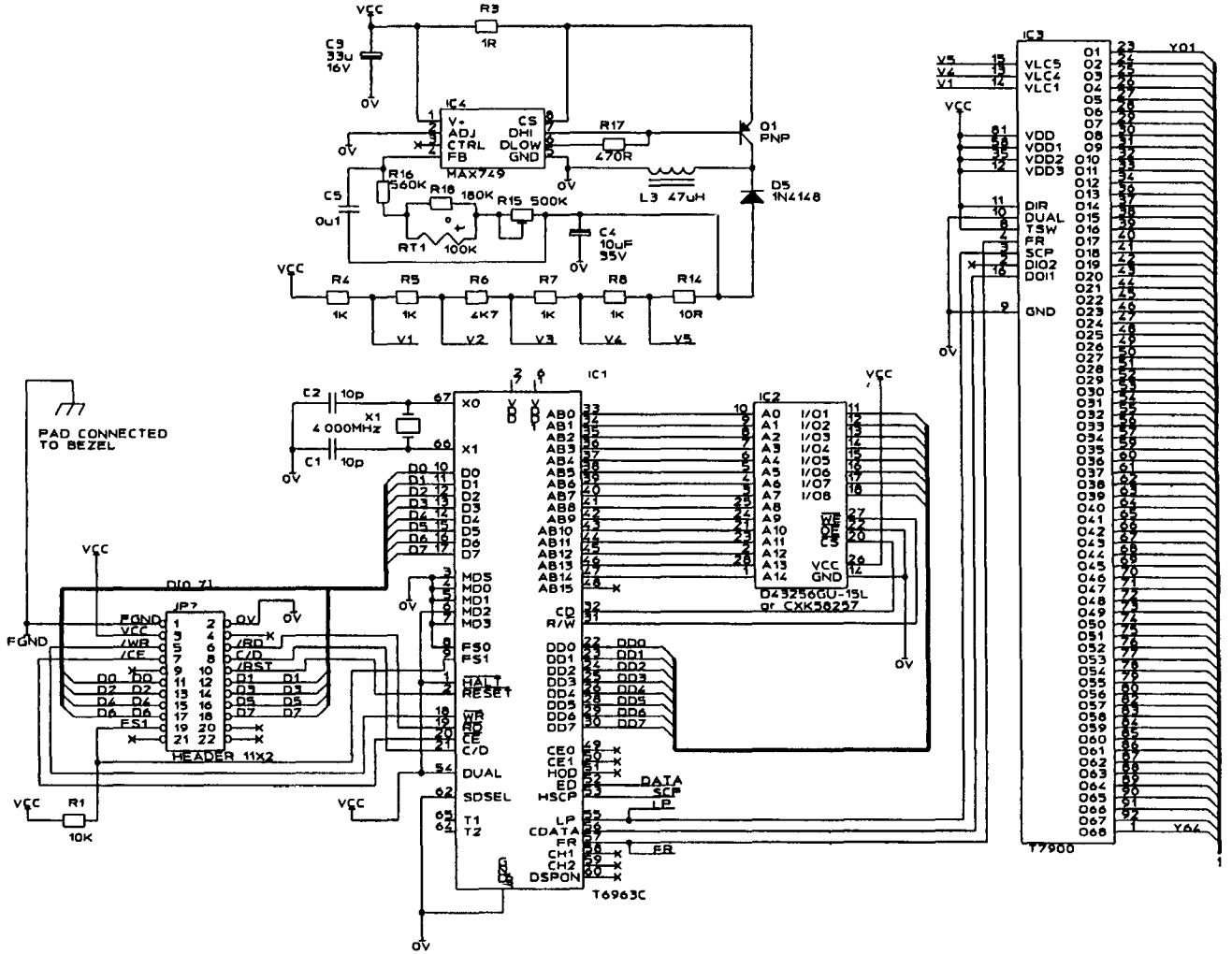
Part Number	Reference	Description	Qty
0000EL00271	R21	RESISTOR 560K 0.25W 2%	1.0
0000EL00247	R22,25,51,54	RESISTOR 470R 0.25W	4.0
0000EL00248	R23,24,26,30	RESISTOR 10K 0.25	4.0
0000EL00241	R3	RESISTOR 5K6 0.25W 2%	1.0
0000EL00248	R31,41,48,62	RESISTOR 10K 0.25	4.0
0000EL00249	R33,34,36,37	RESISTOR 75K 0.25W	4.0
0000EL00244	R35,46,47,49	RESISTOR 100K 0.25W 2%	4.0
0000EL00250	R38,39	RESISTOR 300R 0.25W	2.0
0000EL00249	R40	RESISTOR 75K 0.25W	1.0
0000EL00251	R42,53,67,69	RESISTOR 2K2 0.25W	4.0
0000EL00252	R43	RESISTOR 2K7 0.25W	1.0
0000EL00242	R5,29	RESISTOR 2M2 0.125W	2.0
0000EL00244	R50,56,57,58	RESISTOR 100K 0.25W 2%	4.0
0000EL00472	R52,68,70,72	RESISTOR 20K (SMT)	4.0
0000EL00244	R59,60,64,65	RESISTOR 100K 0.25W 2%	4.0
0000EL00243	R6,13,16,17	RESISTOR 200K 0.25W 2%	4.0
0000EL00248	R63,66,71,74	RESISTOR 10K 0.25	4.0
0000EL00244	R7,12,14,15	RESISTOR 100K 0.25W 2%	4.0
0000EL00517	R73	RESISTOR 560R (SMT)	1.0
0000EL00248	R76	RESISTOR 10K 0.25	1.0
0000EL00248	R77	RESISTOR 10K 0.25	1.0
0000EL00245	R8	RESISTOR 22R 0.25W 2%	1.0
0000EL00246	R9,75	RESISTOR 1K0 0.25W	2.0
0000EL00044	RV1	POTENTIOMETER 10K 25 TURNS	1.0
0000EL00450	SKT-IC20	IC SOCKET 32W-DIL TURNED PIN	1.0
1000EL00141	SW1	SWITCH REED FR TRG291 P5	1.0
0000EL00277	TR12,13	TRANSISTOR ZTX849 NPN ZETEX	2.0
0000EL00225	TR2,11	TRANSISTOR BC856 PNP S/M	2.0
0000EL00021	TR3,7	TRANSISTOR FZT 751 SOT22 3	2.0
0000EL00067	TR4	TRANSISTOR ZTX651 SOT223	1.0
0000EL00226	TR5,6,8,9,10	TRANSISTOR BC846 NPN S/M	5.0
0000EL00128	Y1,3	CRYSTAL 32.768KHZ WATCH	2.0
0000EL00315	Y2	CRYSTAL 20.0MHZ HC49/4U	1.0

5.5 Display Board :

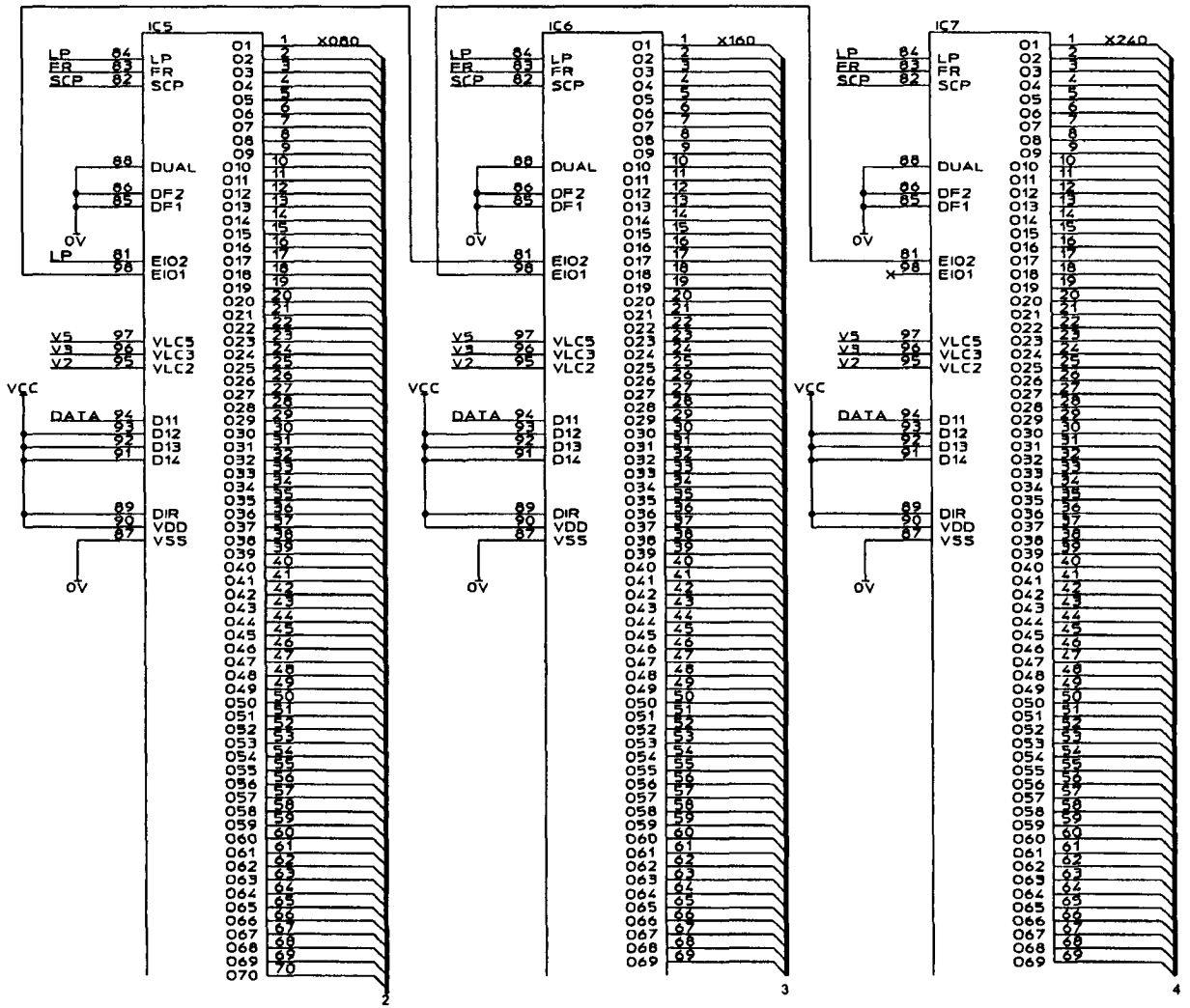
5000EL00036 Display Board Schematic (not issue controlled)

Display Board 5000EL00036 can only be purchased as a module therefore it has no Bill of Materials or Component Layout.

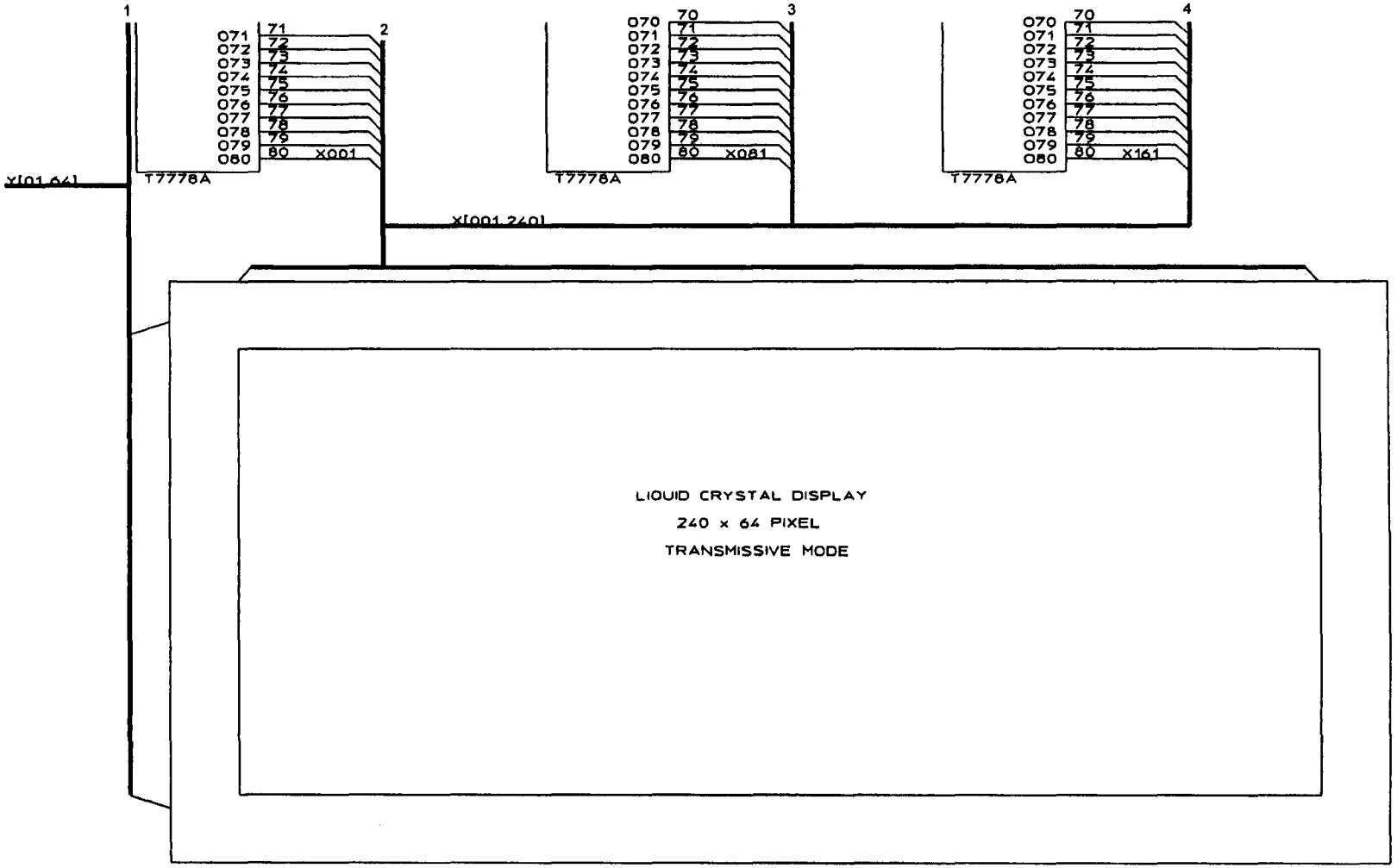
See next sheet.



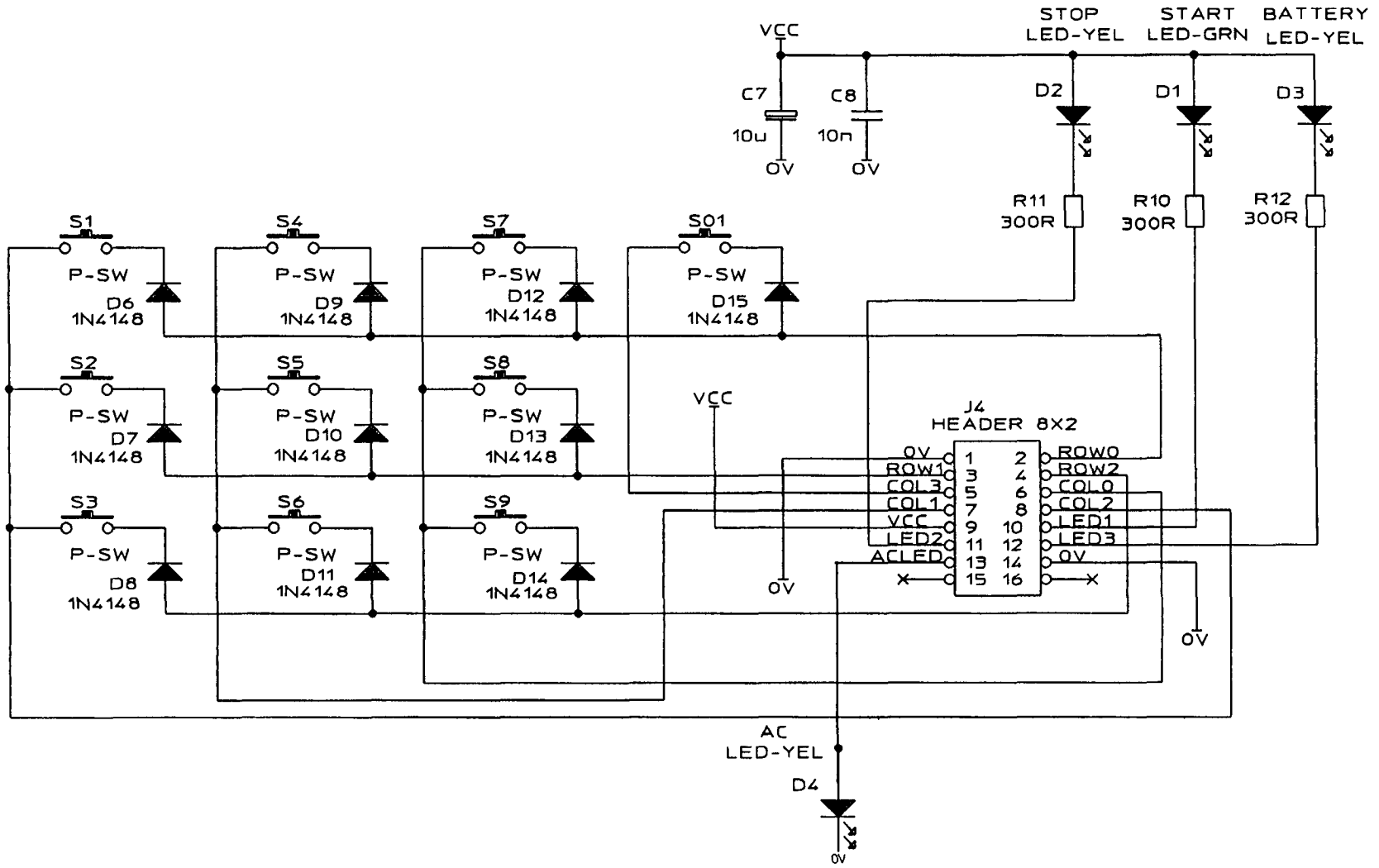
5000EL00036 Display Board Schematic
(not issue controlled)



5000EL00036 Display Board Schematic
(not issue controlled)



5000EL00036 Display Board Schematic
(not issue controlled)

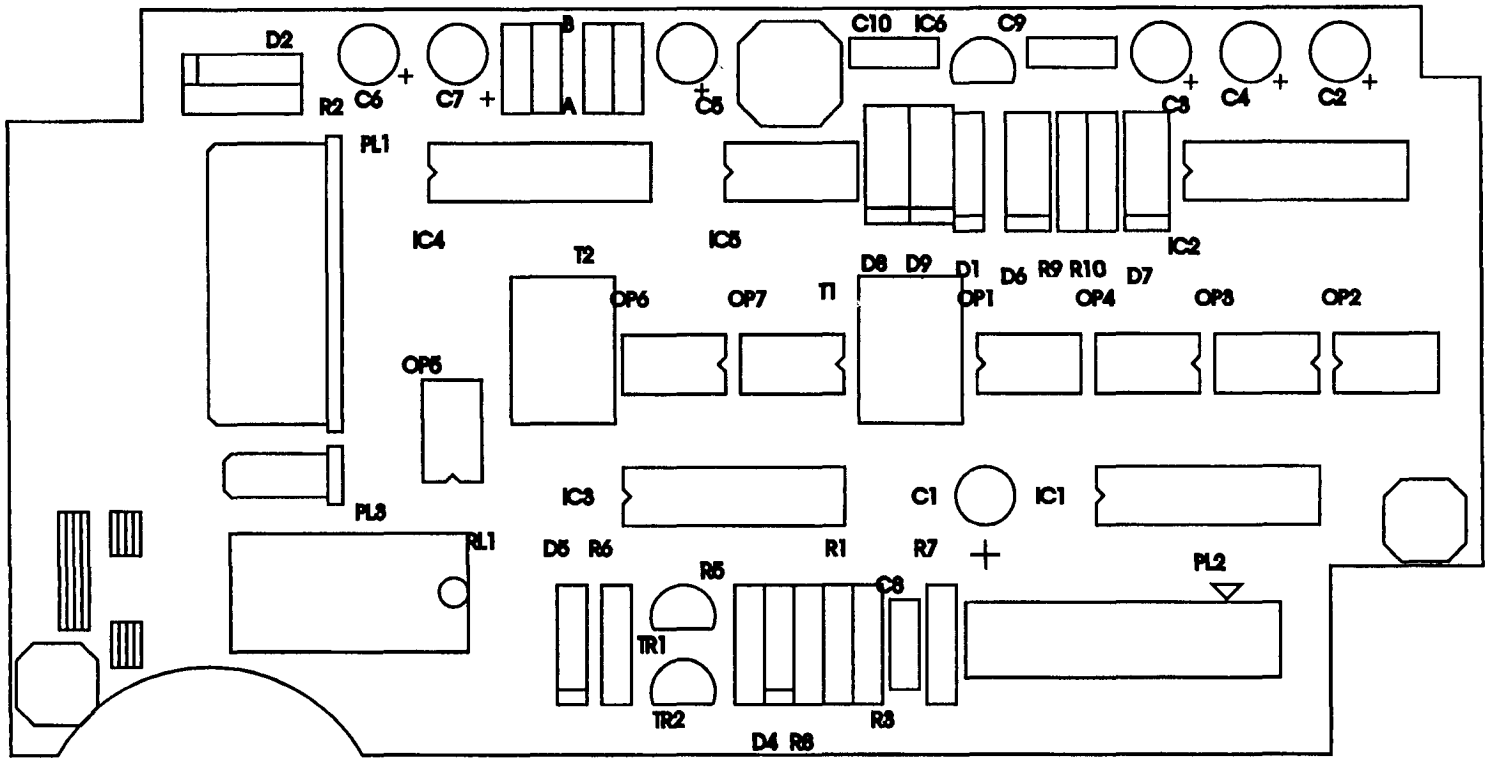


5000EL00036 Display Board Schematic
(not issue controlled)

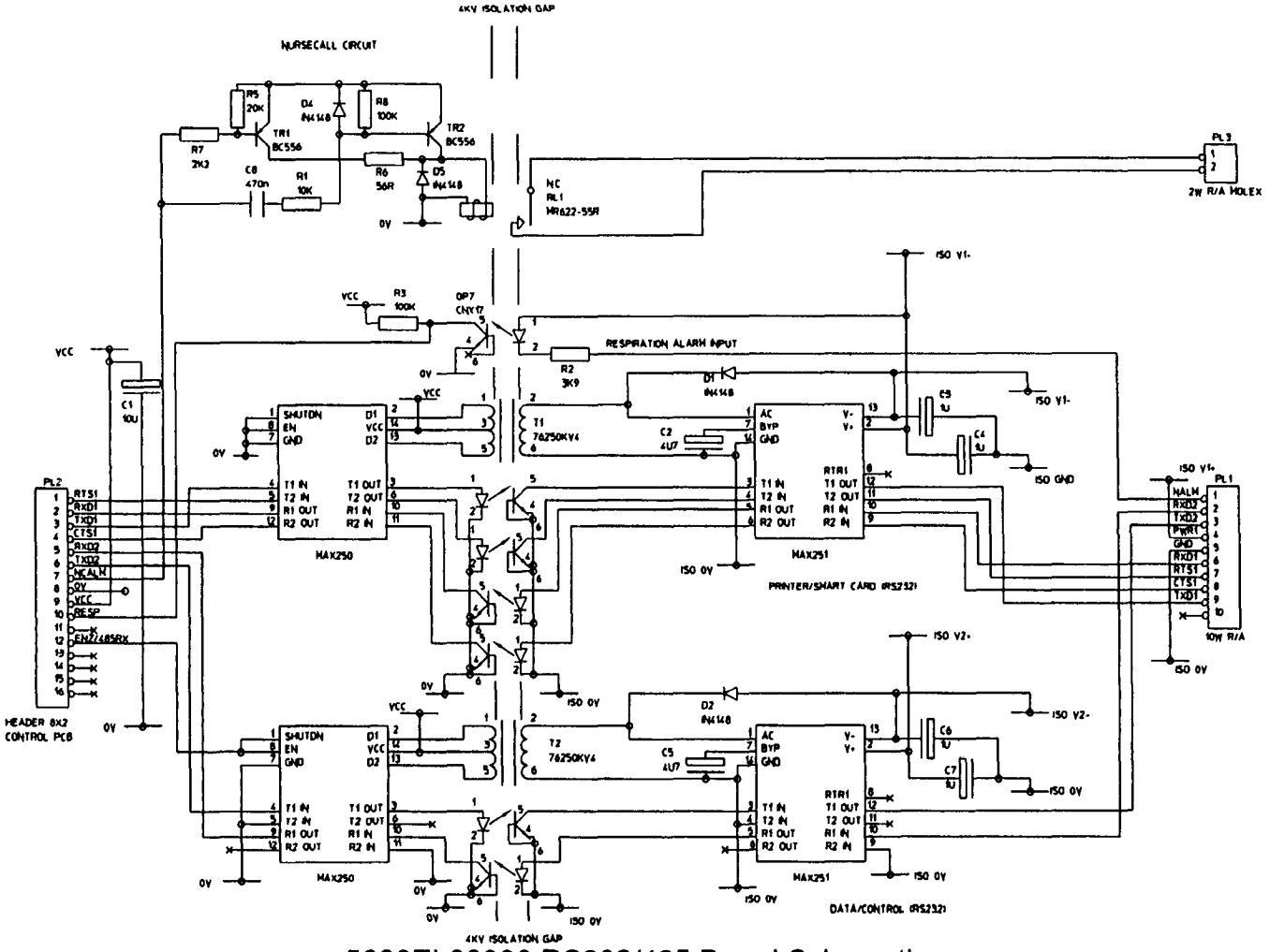
5.6 RS232/485 Board :

5000EL00017	Component Layout	(not issue controlled)
5000EL00003	RS232/485 Board Schematic	(not issue controlled)
5000EL00022	BOM RS232 Board	(not issue controlled)
5000EL00028	BOM RS232/485 Board	(not issue controlled)

See next sheets.



5000EL00017 RS232/RS485 Board
Component Location (not issue controlled)



5000EL00003 RS232/485 Board Schematic
(not issue controlled)

Item Number: 5000EL00022 ASSY PCB ISOLATED RS232/ Iss: 4

Assembly Notes:

1. THERE IS NO NEED TO SPLASH SOLDER PADS ON THIS ASSEMBLY (RS232). PADS ALLOW CONVERSION TO RS485 WITH THE KIT 5000EL00028 IF REQUIRED.
2. ALL COMPONENT LEADS TO BE CROPPED TO WITHIN 1mm OF THE BOARD UNLESS OTHERWISE STATED.

Part Number	Reference	Description	Qty
5000EL00017	1	PCB BLANK DUAL RS232 P5000	1.0
5000PR00009	2	PROC TEST/BUILD RS232 ASSY	1.0
0000EL00054	C1	CAPACITOR 10u 16V TANT	1.0
0000EL00150	C2,5,7	CAPACITOR 4u7 16 V TANT	3.0
0000EL00029	C3,4,6	CAPACITOR 1u0 35V TANT	3.0
0000EL00077	C8	CAPACITOR 470n 50 V CERAMIC	1.0
0000EL00016	D1,2,4,5	DIODE IN4148	4.0
0000EL00152	IC1,3	IC TYPE MAX 250	2.0
0000EL00153	IC2,4	IC TYPE MAX 251	2.0
0000EL00151	OP1,2,3,4,5	ISOLATOR OPTO CNY17	5.0
0000EL00151	OP6,7	ISOLATOR OPTO CNY17	2.0
0000EL00204	PL1	CONNECTOR 10 WAY R/A	1.0
5000EL00049	PL2	ASSY CABLE 16 WAY RIBBON	1.0
0000EL00147	PL3	CONNECTOR 2 WAY R/A PLUG	1.0
0000EL00042	R1	RESISTOR 10K 0.25W 1%	1.0
0000EL00036	R2,7	RESISTOR 2K2 0.25W 1%	2.0
0000EL00035	R3,8	RESISTOR 100K 0.25W 1%	2.0
0000EL00040	R5	RESISTOR 20K 0.25W 1%	1.0
0000EL00142	R6	RESISTOR 56R 0.25W 1%	1.0
0000EL00148	RL1	RELAY ISOLATED 5V MR622-5SR	1.0
0000EL00149	T1,2	TRANSFORMER ISOLATED RS232	2.0
0000EL00020	TR1,2	TRANSISTOR BC556	2.0

Item Number: 5000EL00028 ASSY PCB ISOLATED RS232/ Iss: 3

Assembly Notes:

1. CUT 4 TRACKS AT END 'A' OF THE TRIPLE SOLDER SPLASH PADS - CUT TRACKS BETWEEN PADS 2 AND 3 - DO NOT CUT HORIZONAL TRACKES BETWEEN PADS 3. SOLDER BRIDGE THE PADS AT THE END 'B' - SOLDER BETWEN THE PADS 1 AND 2 IN ALL 4 POSITIONS.

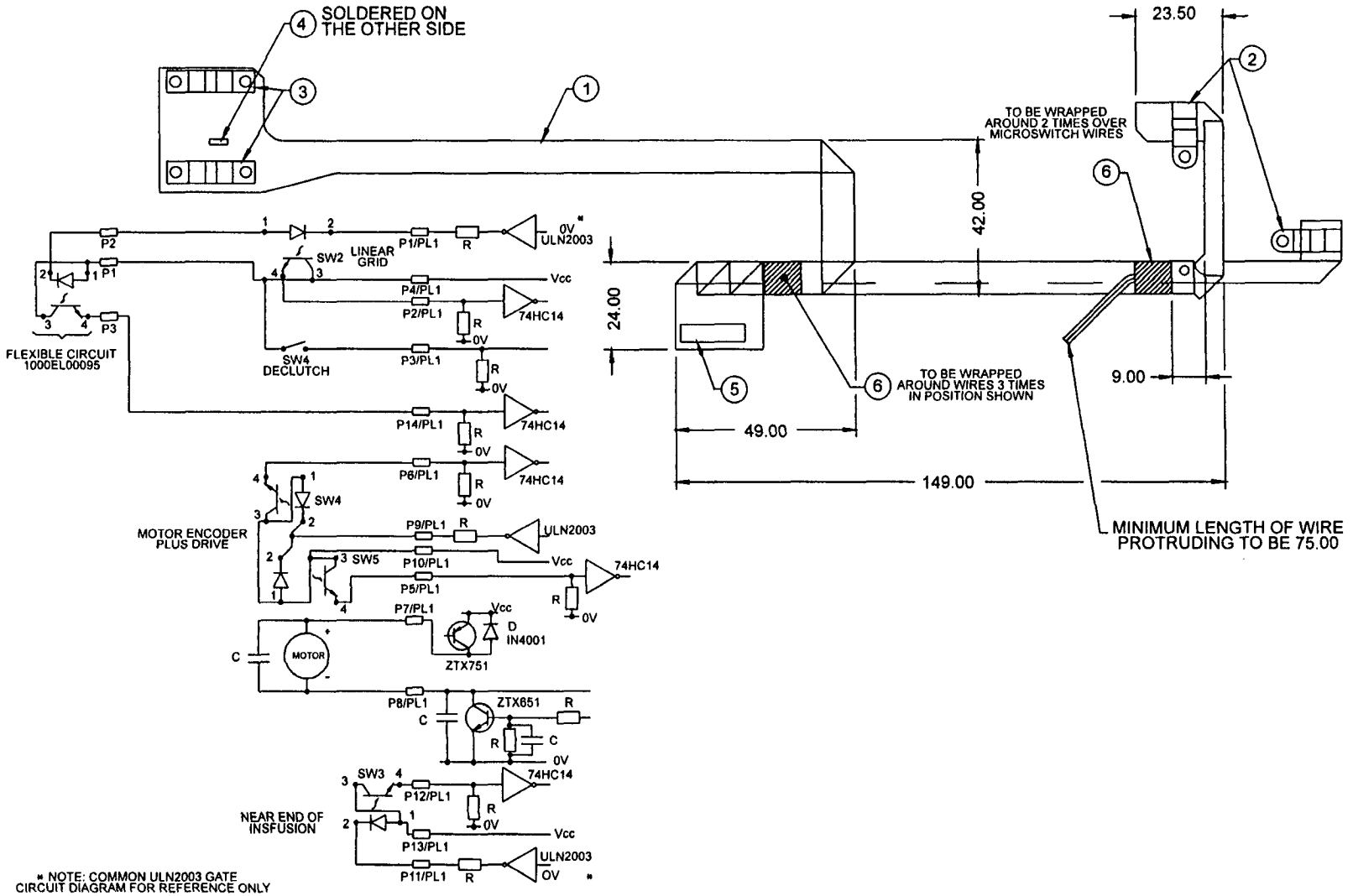
   1 1 B 1 1
   2 2 2 2
   3 3 A 3 3
2. THE ASSEMBLY PART NUMBER '28' IN THE IDENT BOX AND CROSS OFF THE STANDARD RS232 ASSY DIGITS '22'. ASSEMBLY ISSUE AS THIS BILL OF MATERIALS.
3. ALL COMPONENT LEADS TO BE CROPPPED TO WITHIN 1mm OF THE BOARD UNLESS OTHERWISE STATED.

Part Number	Reference	Description	Qty
5000EL00022	ASSY 1	ASSY PCB ISOLATED RS232/ NC	1.0
0000EL00077	C9,10	CAPACITOR 470n 50 V CERAMIC	2.0
0000EL00017	D6,7,8,9	DIODE 11DQ03	4.0
0000EL00207	IC5	IC TYPE LTC485CN RS485 DRIVER	1.0
0000EL00324	IC6	IC TYPE 78L05 5V REGULATOR	1.0
0000EL00042	R9,R10	RESISTOR 10K 0.25W 1%	2.0

5.7 Flexible Circuit Assembly:

1000SP01006	Circuit Diagram	(not issue controlled)
1000SP01006	Bill of Materials	(not issue controlled)
1000SP01040	Circuit Diagram	(not issue controlled)
1000SP01040	Bill of Materials	(not issue controlled)
1000SP01007	Circuit Diagram	(not issue controlled)
1000SP01007	Bill of Materials	(not issue controlled)

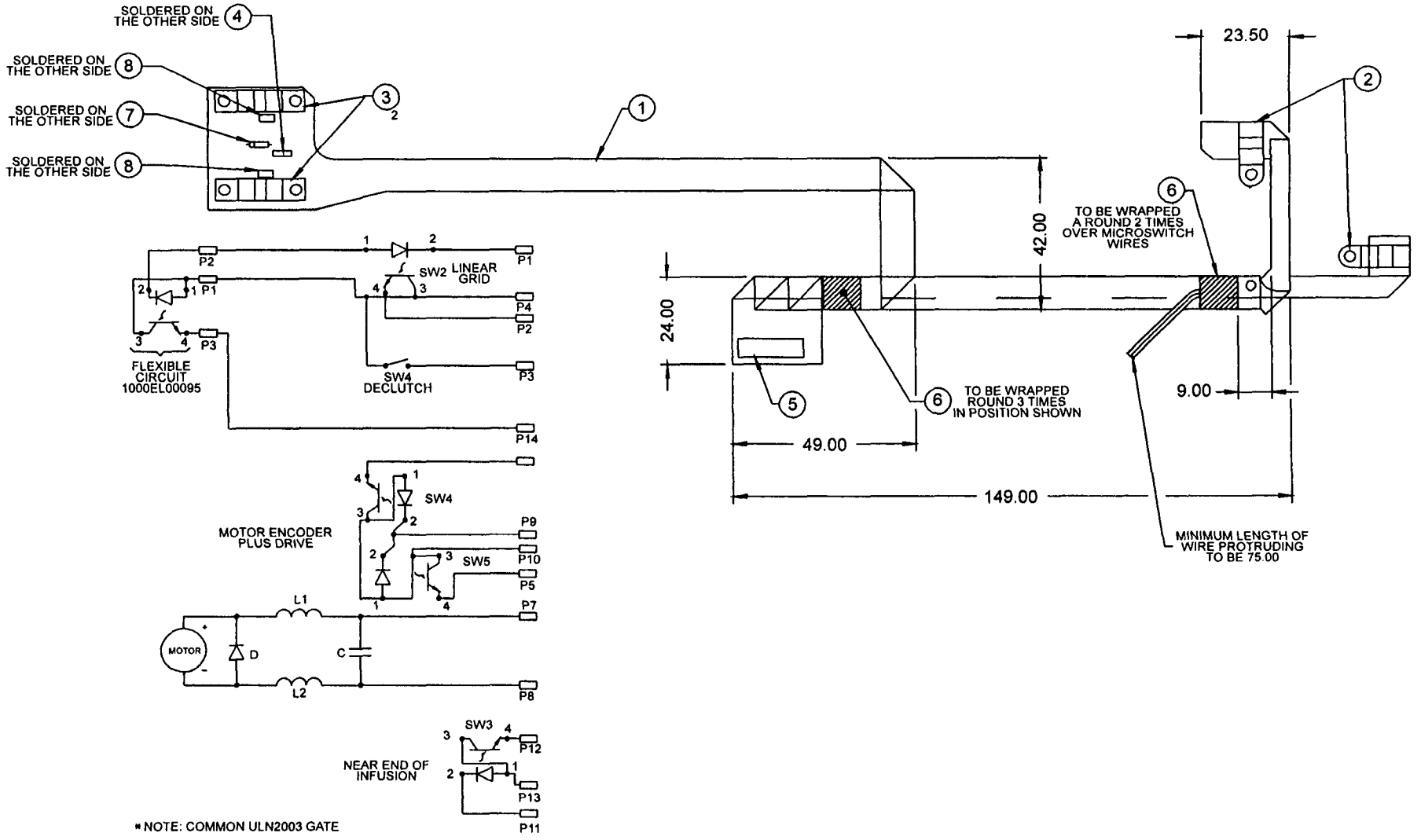
See next sheet.



FLEXIBLE CIRCUIT ASSY 1000SP01006
(not issue controlled)

Item Number: 1000SP01006 ASSY CIR FLEXI NO.1 Iss: 5

Part Number	Reference	Description	Qty
1000EL00094	1	OUTLINE FLEXIBLE CIRCUIT	1.0
0000EL00185	2	SWITCH OPTO SLOTTED SINGLE	2.0
0000EL00003	3	SWITCH OPTO SLOTTED DUAL	2.0
0000EL00141	4	CAPACITOR 100nF CERAMIC CHIP	1.0
0000EL00106	5	CONNECTOR PLUG 14 WAY	1.0
0000ME00238	6	TAPE PVC 12mm BLACK	0.1



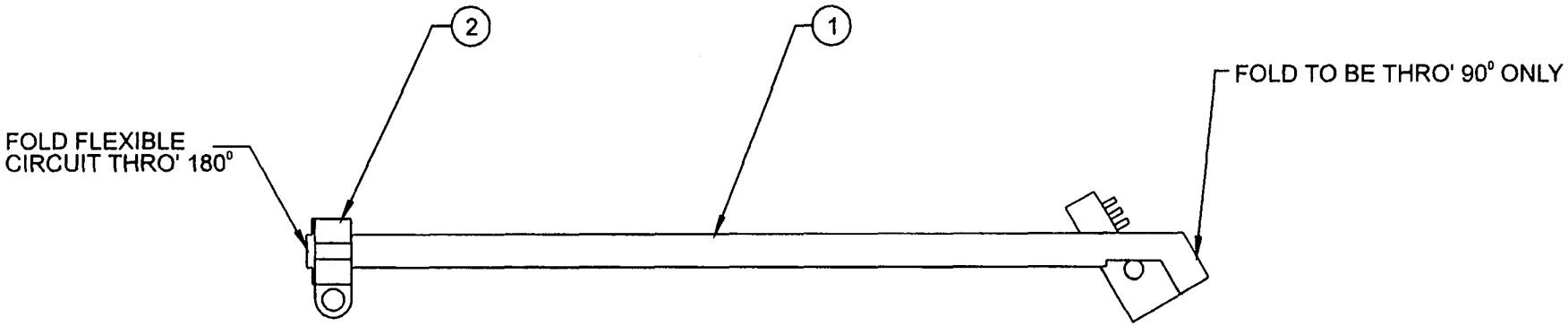
FLEXIBLE CIRCUIT ASSEMBLY 1000SP01040
(not issue controlled)

Item Number: 1000SP01040 ASSY FLEX CIR NO1 P1-3/5 Iss: 4

Assembly Notes:

ASSY FLEXIBLE CIRCUIT MUST HAVE THE 'P4' MARK DELETED WITH BLACK PERMANENT MARKER TO IDENTIFY THE FLEXI TYPE.

Part Number	Reference	Description	Qty
1000EL00094	1	OUTLINE FLEXIBLE CIRCUIT	1.0
0000EL00185	2	SWITCH OPTO SLOTTED SINGLE	2.0
0000EL00003	3	SWITCH OPTO SLOTTED DUAL	2.0
0000EL00141	4	CAPACITOR 100nF CERAMIC CHIP	1.0
0000EL00106	5	CONNECTOR PLUG 14 WAY	1.0
0000ME00238	6	TAPE PVC 12mm BLACK	0.01
0000EL00352	7	DIODE ZENER BZX55C15	1.0
0000EL00334	8	INDUCTOR 100uH 10% SM	2.0
0000EL00308	9	CABLE RIBBON 16 WAY	0.1



NOTES:
1. FOLD ON SILKSCREEN FOLD LINES
2. USE LOW MELTING POINT SOLDER ON ALL COMPONENTS (179°C)

FLEXIBLE CIRCUIT ASSEMBLY 1000SP01007
(not issue controlled)

Item Number: 1000SP01007 ASSY CIR FLEXI NO.2 Iss: 2

Part Number	Reference	Description	Qty
1000EL00095	1	FLEXIBLE CIRCUIT PLUNGER	1.0
0000EL00185	2	SWITCH OPTO SLOTTED SINGLE	1.0

Item Number: 5000PP00007 P5 TRANSMISSION UNIQUE Iss: 4

Part Number	Reference	Description	Qty
1000ME00010	5	SPIGOT IDLER	1.0
1000ME01012	8	PLATE MOTOR MTG V4 P1000 /2000/3000	1.0
1000SP01042	24	MOTOR G/BOX V4 ASSY P100 0/2000/3000/5000	1.0
1000SP01040	100	ASSY FLEX CIR NO1 P1-3/5	1.0
0000ME00027	220	WASHER M5 PLAIN Z+C	1.0
1000ME01109	221	GEAR TRANSMISSION 35T P1	3.0
0000ME00002	222	CIRCLIP E TYPE SHAFT DIA 4.8	1.0

6.3 Transmission Unique Assembly 5000PP00007

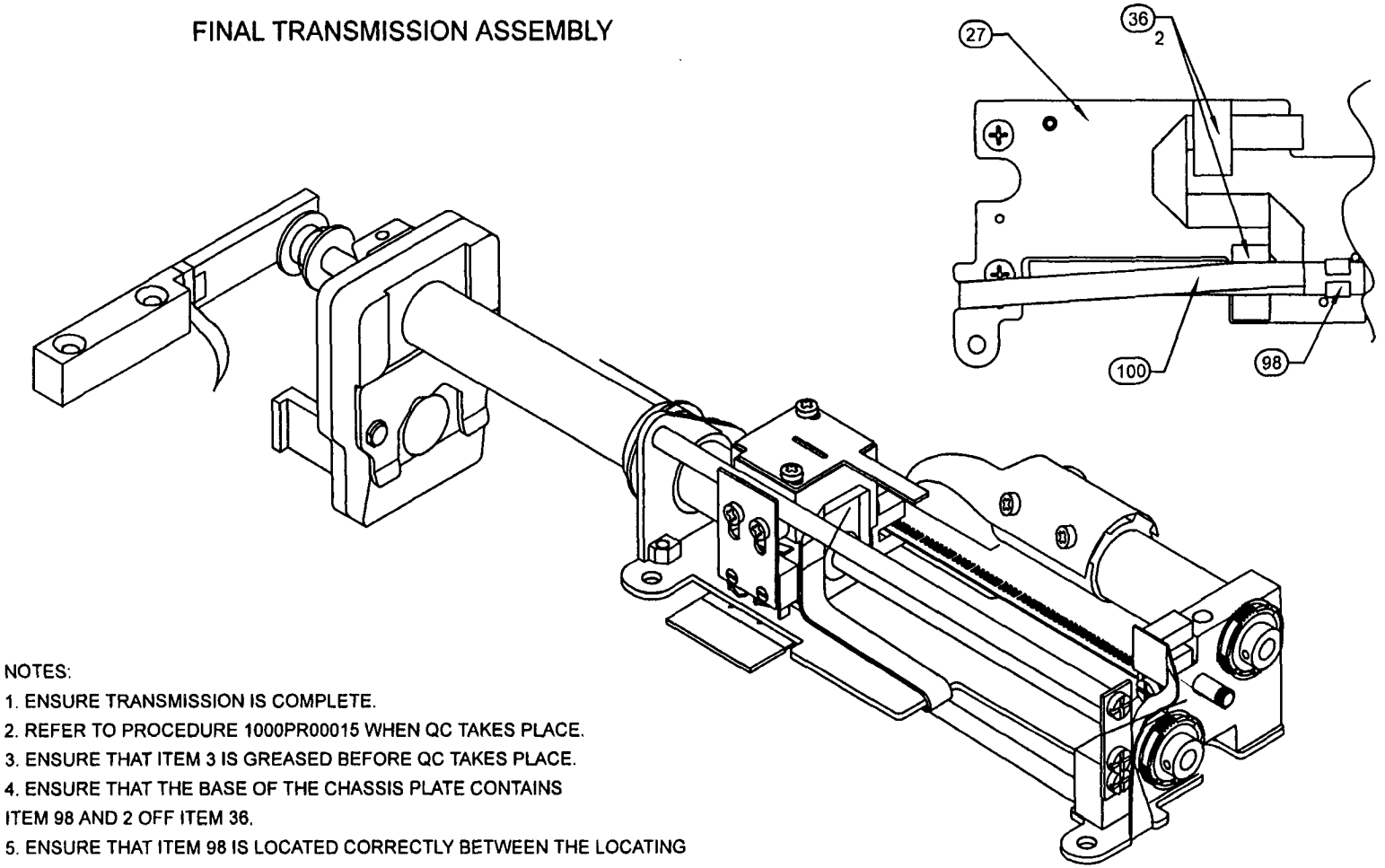
See next sheet.

Bill of Materials Print ALARIS MEDICAL SYSTEMS

Item Number: 1001PP00004 V4 TRANS KIT COMMON Iss: 33

Part Number	Reference	Description	Qty
1000ME01121	1	SEAL OUTER TUBE RECESSED	1.0
1000ME01112	2	SEAL LEADSCREW MOULDED	1.0
1000ME01011	3	LEADSCREW V4	1.0
1000ME00097	4	HALFNUT V4	1.0
1000ME00174	6	ENCODER MOTOR	1.0
1000ME01069	7	MOUNT OPTO MOULDED V4	1.0
1000ME01013	9	CARRIAGE V4	1.0
1000ME01122	10	TUBE OUTER 'O' RING GROOVE	1.0
7000ME00015	12	ROD TORSION P7000	1.0
1000ME01056	14	PLATE PLUNGER RESTRAINT	1.0
1000ME01059	15	HOLDER PLUNGER V4	1.0
1000ME01116	16	LEVER DECLUTCH FLUID SEAL	1.0
1000SP00003	19	ASSY BEAM BONDED	1.0
1000ME00048	20	PLATE TORSION MOTOR END	1.0
1000ME01019	21	TUBE INTERMEDIATE ASSY	1.0
1000ME00108	22	ACTUATOR NEOI	1.0
1000ME00177	23	SPACER DUAL TRANSMISSION	1.0
1000ME01113	26	BUSH MOTOR BEARING MOULDED	1.0
1000ME01021	27	PLATE CHASSIS V4	1.0
1000ME01022	28	PLATE OUTER TUBE SEAL V4	1.0
1000ME01117	29	PLATE BACK PLUNGER HOLDE R FLUID SEAL	1.0
1000ME01107	30	GASKET PLUNGER HOLDER MOULDED A4	1.0
1000ME01114	31	BUTTON PLUNGER HOLDER MOULDED	1.0
1000ME01026	32	HOLDER PLUNGER CRUCIFORM	1.0
1000ME01027	33	PIN PLUNGER PLATE	2.0
1000ME01111	34	SEAL BACKPLATE A4	1.0
1000ME01035	35	GRID LINEAR 1.5 PITCH V4	1.0
1000ME01066	36	FOAM PAD CHASSIS PLATE	2.0
1000SP01022	37	ASSY MICROSWITCH V4	1.0
1000EL00123	48	DIAGRAM WIRING P1000/P20 00	1.0
1000SP01007	50	ASSY CIR FLEXI NO.2	1.0
0000ME00002	52	CIRCLIP E TYPE SHAFT DIA 4.8	1.0
0000ME00003	53	SPRING COMP OD 6.1 19 LONG	1.0
0000ME00133	54	SPRING COMPRESSION 2.24 DIA x 7.9mm	2.0
0000ME00034	55	GREASE MOLYBDENUM DISULPHIDE	0.05
1000ME01047	56	SEAL RING OUTER TUBE	1.0
0000ME00136	57	O RING 13.0 I/D x 1.5	2.0
1000ME01048	58	SEAL RING LEADSCREW	1.0
0000ME00084	59	SCREW M2x12 CSK HD SLOTT ED	2.0
0000ME00221	63	SCREW M3x6 PAN HD POSI ZP+P	11.0
0000ME00222	64	SCREW M3x6 CSK HD POSI 1 Z+BLACK	4.0
0000ME00009	65	SCREW M3x5 CSK SET CUP	1.0
0000ME00030	66	SCREW M3x8 SKT SET FULL	2.0
0000ME00146	67	SCREW M3x8 SKT SET PART	3.0
0000ME00246	68	SCREW M4x8 PAN HD POSI	2.0
0000ME00011	69	SCREW No4 X 1/4" PAN HD	7.0
0000ME00031	70	SCREW No4x3/8" PAN HD	2.0
0000ME00032	71	SCREW No4x1/2" PAN HD	2.0
0000ME00292	76	NUT M3 A2 STAINLESS STEE L	1.0
0000ME00044	78	WASHER M3 NYLON	2.0
0000ME00015	79	WASHER M3 WAVEY SST	9.0
0000ME00027	80	WASHER M5 PLAIN Z+C	1.0
0000ME00045	81	WASHER M4 WAVEY SST	2.0
0000ME00048	82	WASHER M3 PLAIN Z+C	2.0
0000ME00016	83	PIN TENSION DIA 2.0x10mm	4.0
0000ME00018	85	PIN TENSION DIA 2.0x20mm	1.0
0000ME00132	86	PIN TENSION DIA 1.5 x 10mm	1.0
0000ME00142	87	PIN TENSION DIA 2.0 x 5.0mm	1.0
0000ME00058	89	GREASE SILICONE	0.05
0000ME00051	92	ADHESIVE LOCTITE 242	0.05
0000ME00052	93	ADHESIVE LOCTITE 495	0.05
0000EL00100	95	CABLE BLACK 7/0.2	0.1
0000EL00101	96	CABLE RED 7/0.2	0.1
0000ME00134	97	SPRING COMPRESSION 5.33 DIA x 7.9mm	2.0
0000EL00095	98	CLIP CABLE SELF ADHESIVE	1.0
0000ME00237	99	O RING 6.5 x 1.0 NITRILE	2.0
0000ME00277	100	O RING NITRILE 11.5X1.5	1.0

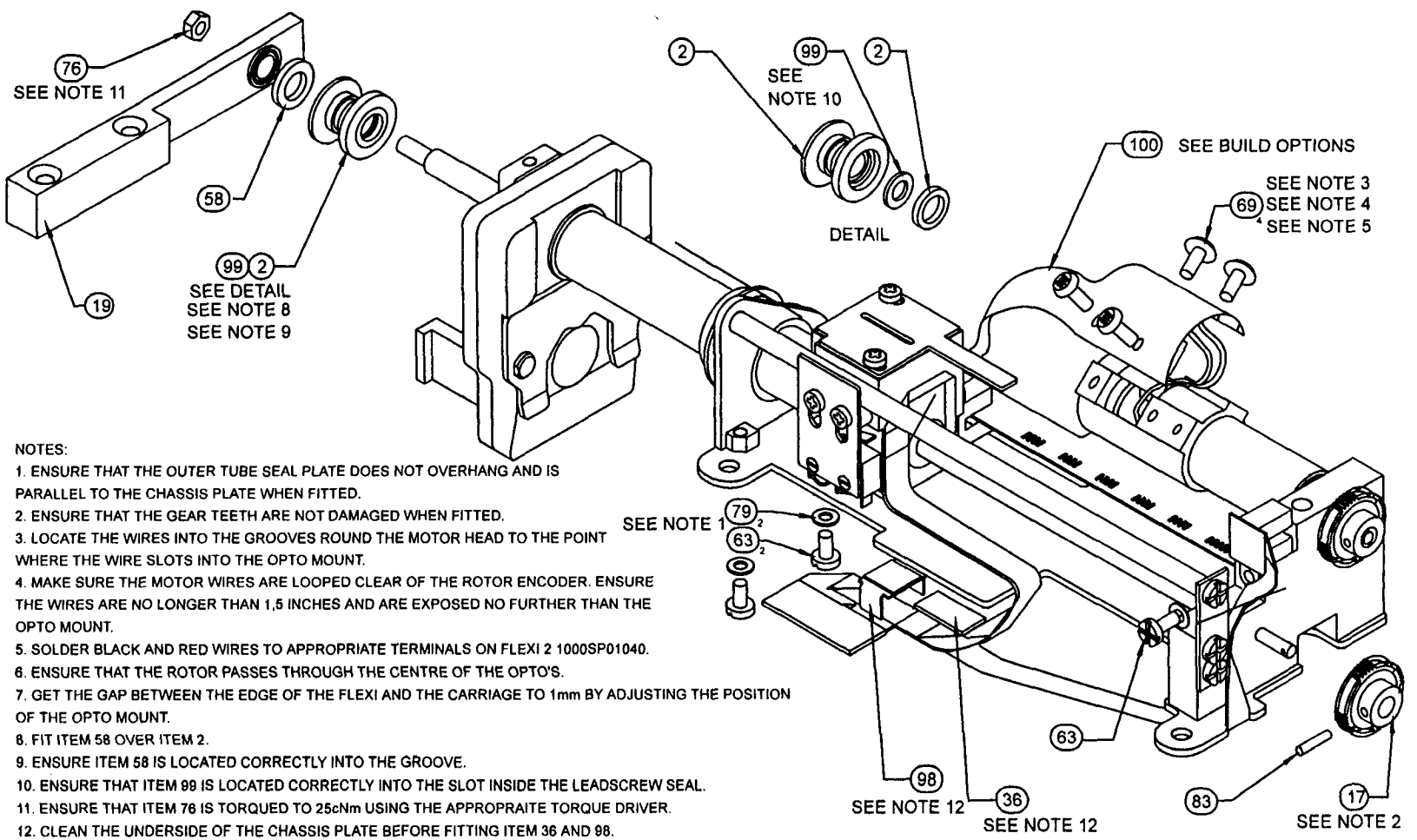
FINAL TRANSMISSION ASSEMBLY



NOTES:

1. ENSURE TRANSMISSION IS COMPLETE.
2. REFER TO PROCEDURE 1000PR00015 WHEN QC TAKES PLACE.
3. ENSURE THAT ITEM 3 IS GREASED BEFORE QC TAKES PLACE.
4. ENSURE THAT THE BASE OF THE CHASSIS PLATE CONTAINS ITEM 98 AND 2 OFF ITEM 36.
5. ENSURE THAT ITEM 98 IS LOCATED CORRECTLY BETWEEN THE LOCATING HOLES.

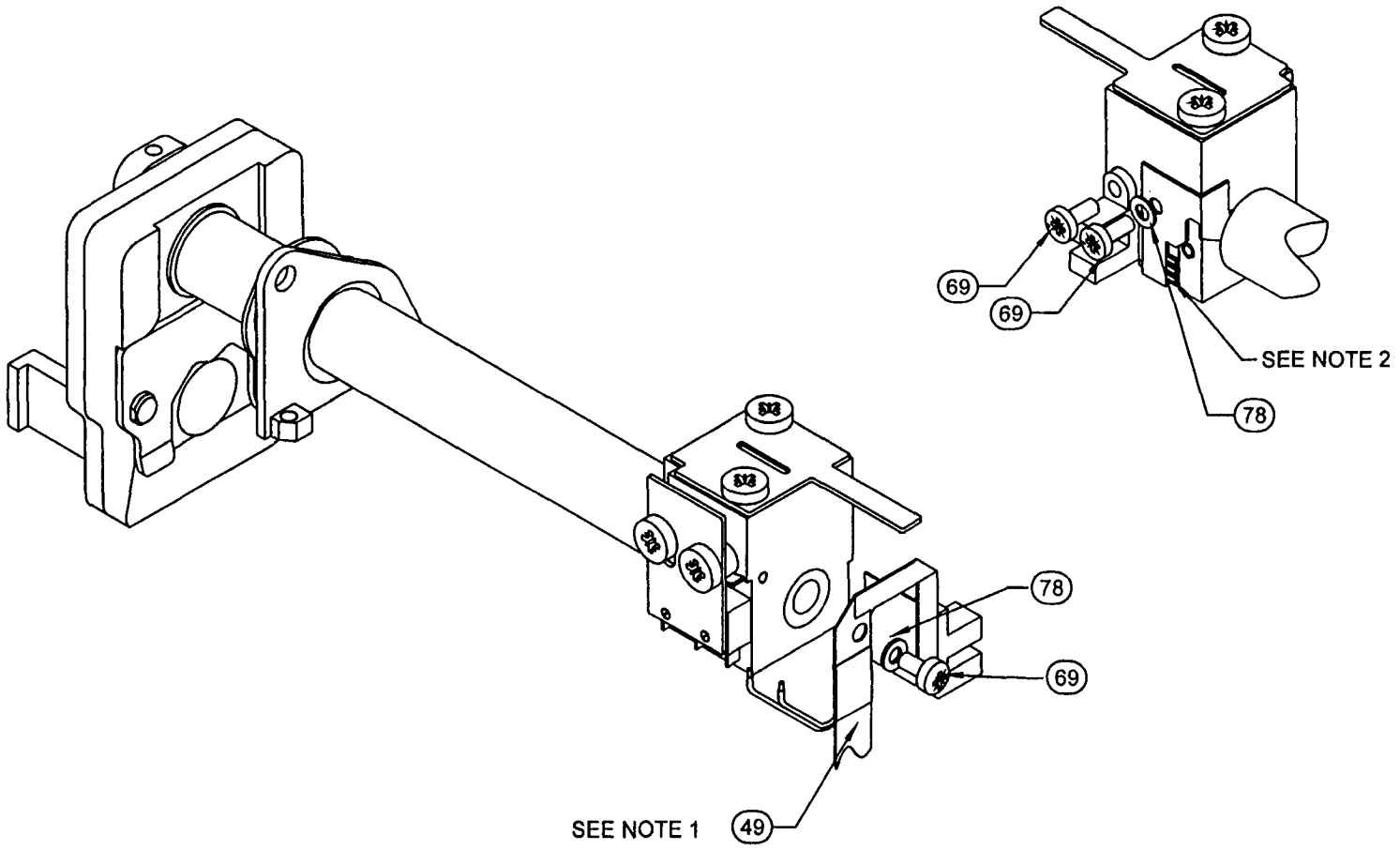
Transmission Assembly
(not issue controlled) 1001PP00004 Sheet 10



NOTES:

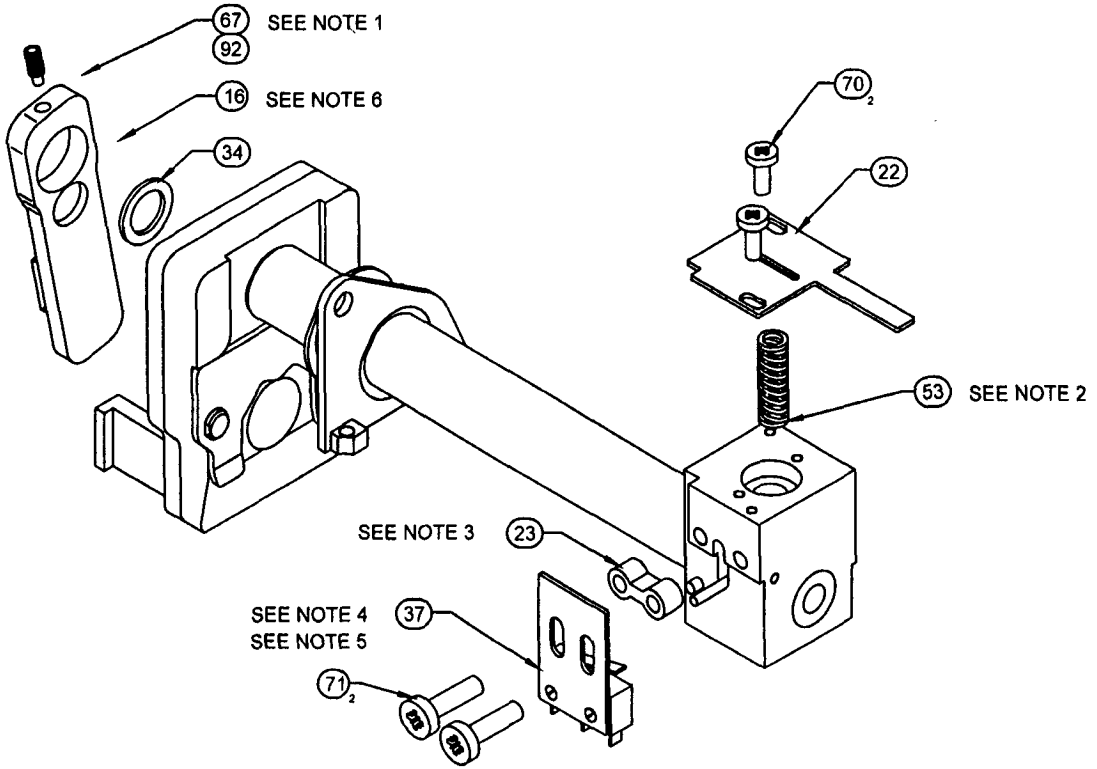
1. ENSURE THAT THE OUTER TUBE SEAL PLATE DOES NOT OVERHANG AND IS PARALLEL TO THE CHASSIS PLATE WHEN FITTED.
2. ENSURE THAT THE GEAR TEETH ARE NOT DAMAGED WHEN FITTED.
3. LOCATE THE WIRES INTO THE GROOVES ROUND THE MOTOR HEAD TO THE POINT WHERE THE WIRE SLOTS INTO THE OPTO MOUNT.
4. MAKE SURE THE MOTOR WIRES ARE LOOPED CLEAR OF THE ROTOR ENCODER. ENSURE THE WIRES ARE NO LONGER THAN 1,5 INCHES AND ARE EXPOSED NO FURTHER THAN THE OPTO MOUNT.
5. SOLDER BLACK AND RED WIRES TO APPROPRIATE TERMINALS ON FLEXI 2 1000SP01040.
6. ENSURE THAT THE ROTOR PASSES THROUGH THE CENTRE OF THE OPTO'S.
7. GET THE GAP BETWEEN THE EDGE OF THE FLEXI AND THE CARRIAGE TO 1mm BY ADJUSTING THE POSITION OF THE OPTO MOUNT.
8. FIT ITEM 58 OVER ITEM 2.
9. ENSURE ITEM 58 IS LOCATED CORRECTLY INTO THE GROOVE.
10. ENSURE THAT ITEM 99 IS LOCATED CORRECTLY INTO THE SLOT INSIDE THE LEADSCREW SEAL.
11. ENSURE THAT ITEM 76 IS TORQUED TO 25cNm USING THE APPROPRAITE TORQUE DRIVER.
12. CLEAN THE UNDERSIDE OF THE CHASSIS PLATE BEFORE FITTING ITEM 36 AND 98.

Transmission Assembly
(not issue controlled) 1001PP00004 Sheet 9



NOTES
1. FIT FLEXI NO. 1 FIRST.
2. ALIGN SOLDER PADS CAREFULLY.

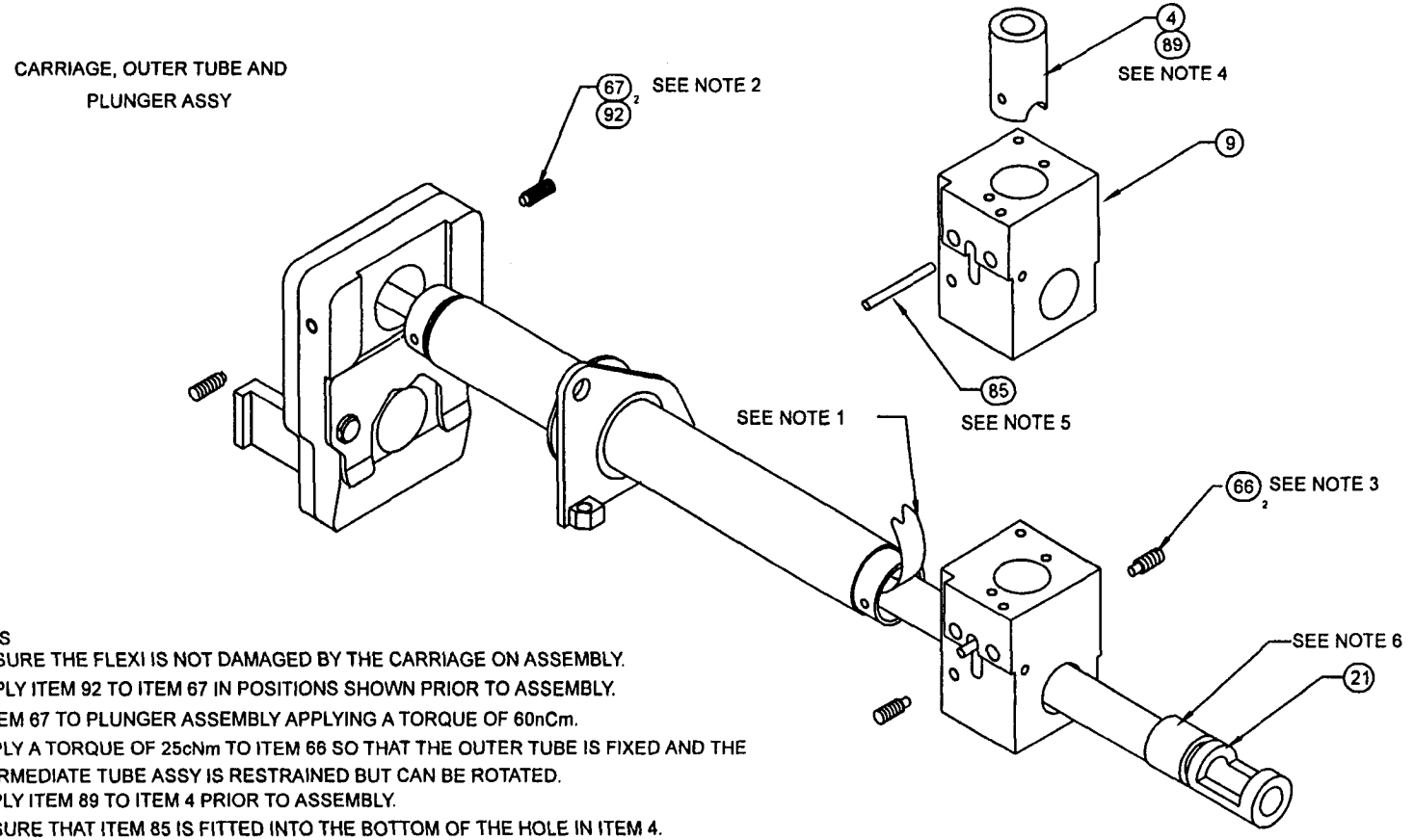
Transmission Assembly
(not issue controlled) 1001PP00004 Sheet 8



NOTES

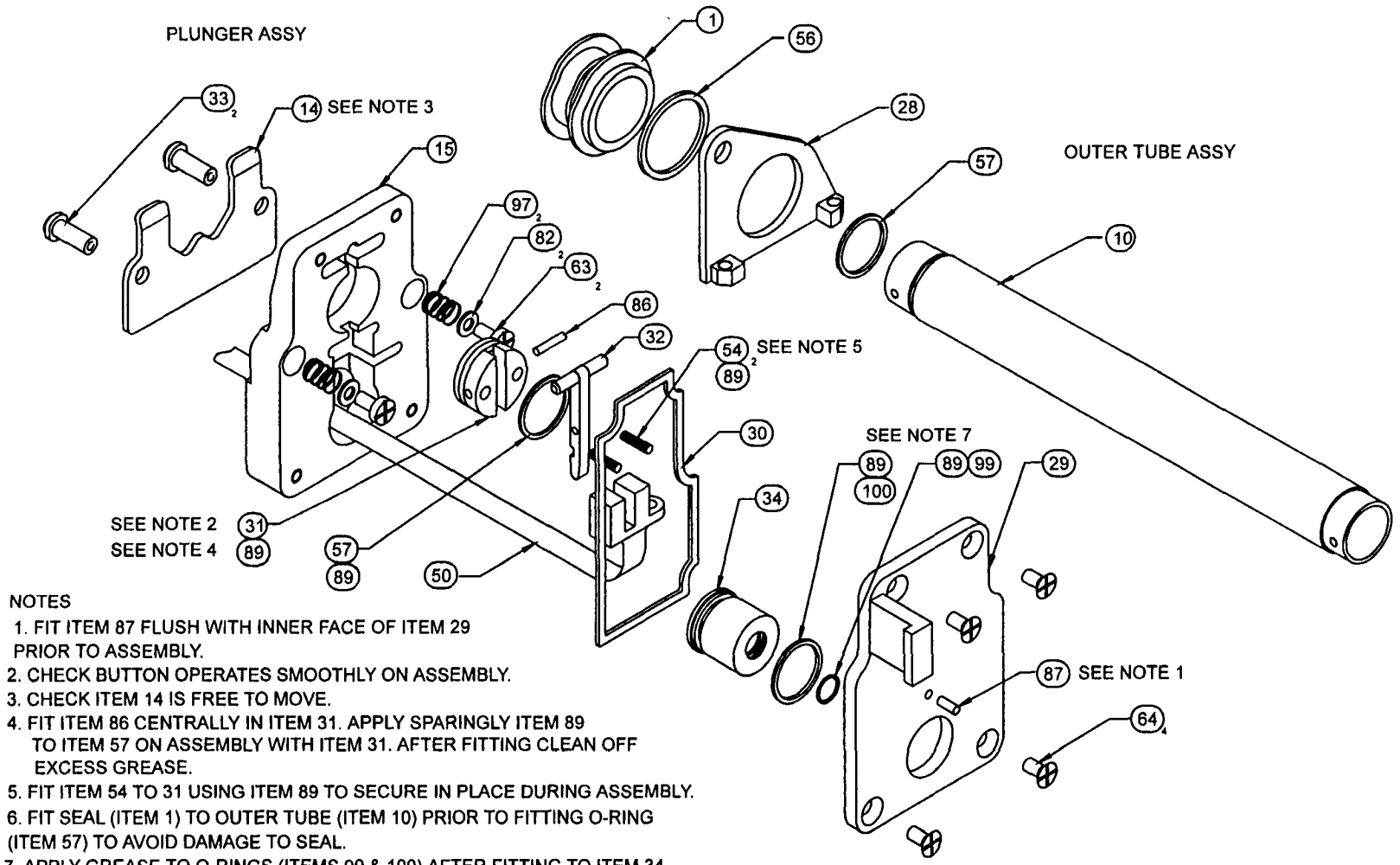
1. APPLY ITEM 92 TO ITEM 67 IN POSITION SHOWN PRIOR TO ASSEMBLY. TORQUE SETTING FOR ITEM 67 TO BE 45cNm.
2. CHECK THE DECLUTCH ACTION FOR A MIS-ALIGNED SPRING.
3. ENSURE THE SPACER IS NOT COMPRESSED EXCESSIVELY DURING FITTING.
4. CHECK THE MICROSWITCH SETTING AT THIS STAGE.
5. MICROSWITCH POSITION TO BE SET WHEN HALF NUT IS FULLY ENGAGED. ADJUST SO THAT THE MICROSWITCH IS ACTUATED WITHIN LIMITS DEFINED BY 0000JG00016.
6. POSITION OF THE DECLUTCH LEVER TO BE SET BY THE HOLE IN THE INTERMEDIATE TUBE.

Transmission Assembly
(not issue controlled) 1001PP00004 Sheet 7



NOTES
1. ENSURE THE FLEXI IS NOT DAMAGED BY THE CARRIAGE ON ASSEMBLY.
2. APPLY ITEM 92 TO ITEM 67 IN POSITIONS SHOWN PRIOR TO ASSEMBLY.
FIT ITEM 67 TO PLUNGER ASSEMBLY APPLYING A TORQUE OF 60nCm.
3. APPLY A TORQUE OF 25cNm TO ITEM 66 SO THAT THE OUTER TUBE IS FIXED AND THE INTERMEDIATE TUBE ASSY IS RESTRAINED BUT CAN BE ROTATED.
4. APPLY ITEM 89 TO ITEM 4 PRIOR TO ASSEMBLY.
5. ENSURE THAT ITEM 85 IS FITTED INTO THE BOTTOM OF THE HOLE IN ITEM 4.
6. APPLY ITEM 89 TO AREA SHOWN PRIOR TO ASSEMBLY.

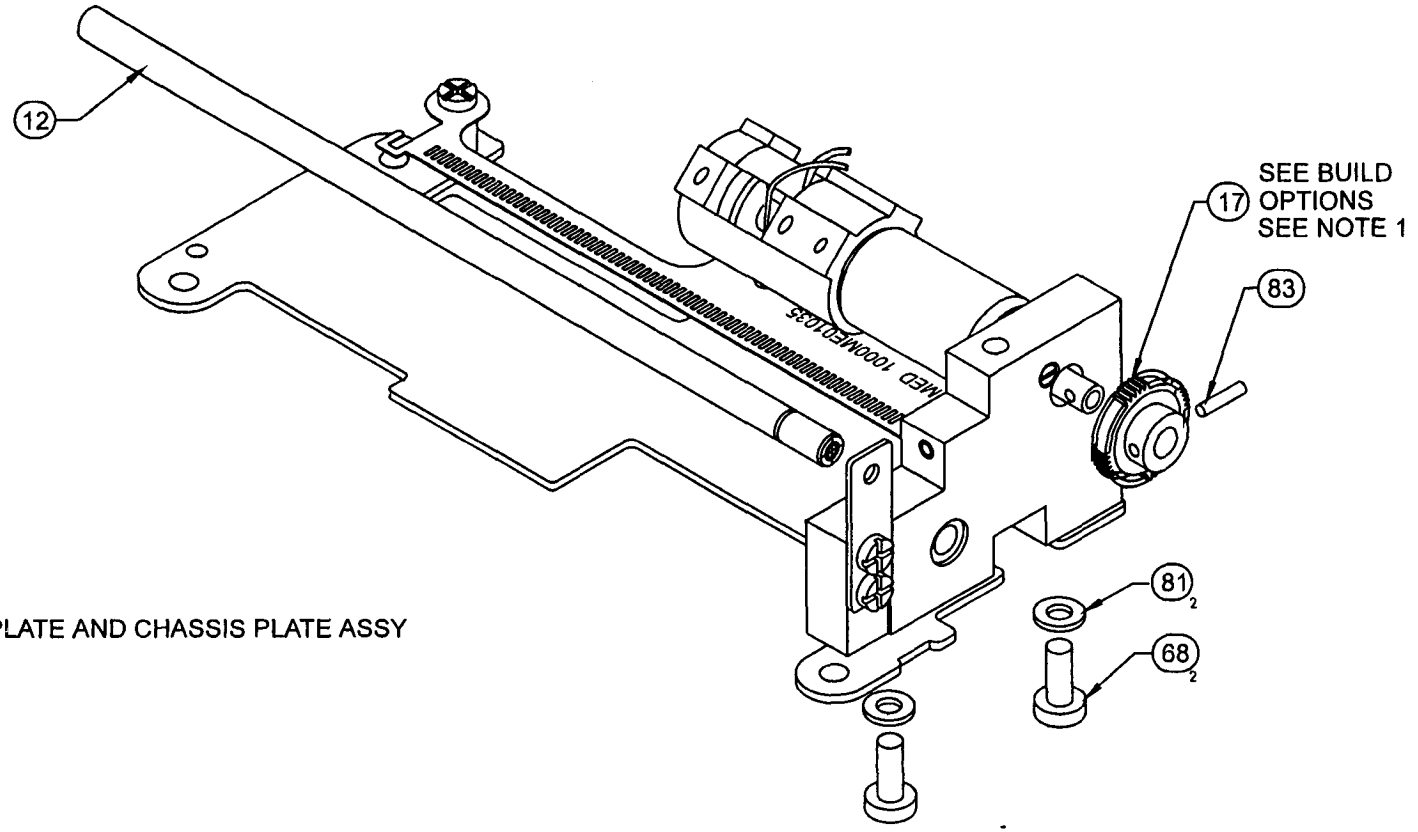
Transmission Assembly
(not issue controlled) 1001PP00004 Sheet 6



NOTES

1. FIT ITEM 87 FLUSH WITH INNER FACE OF ITEM 29 PRIOR TO ASSEMBLY.
2. CHECK BUTTON OPERATES SMOOTHLY ON ASSEMBLY.
3. CHECK ITEM 14 IS FREE TO MOVE.
4. FIT ITEM 86 CENTRALLY IN ITEM 31. APPLY SPARINGLY ITEM 89 TO ITEM 57 ON ASSEMBLY WITH ITEM 31. AFTER FITTING CLEAN OFF EXCESS GREASE.
5. FIT ITEM 54 TO 31 USING ITEM 89 TO SECURE IN PLACE DURING ASSEMBLY.
6. FIT SEAL (ITEM 1) TO OUTER TUBE (ITEM 10) PRIOR TO FITTING O-RING (ITEM 57) TO AVOID DAMAGE TO SEAL.
7. APPLY GREASE TO O-RINGS (ITEMS 99 & 100) AFTER FITTING TO ITEM 34.

Transmission Assembly
(not issue controlled) 1001PP00004 Sheet 5



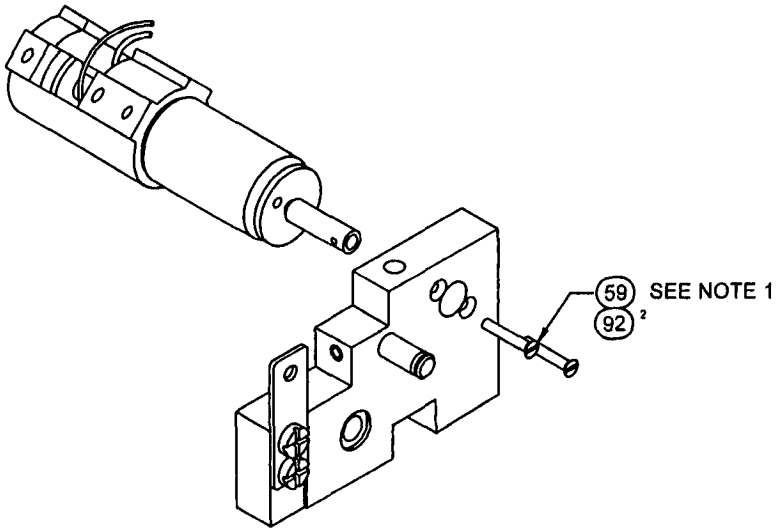
MOTOR PLATE AND CHASSIS PLATE ASSY

NOTES:

1. WHEN FITTING ITEM 83 TAKE CARE NOT TO DAMAGE THE TEETH OR BEND THE GEARBOX OUTPUT SHAFT.
2. ENSURE TORSION ROD 7000ME00015 IS USED. REF No. 12

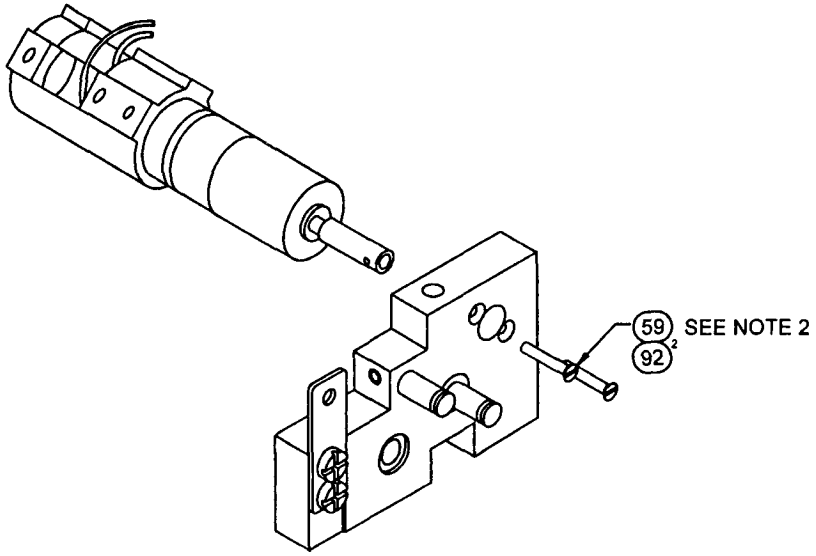
Transmission Assembly
(not issue controlled) 1001PP00004 Sheet 4

P1000/P2000/P3000/P5000



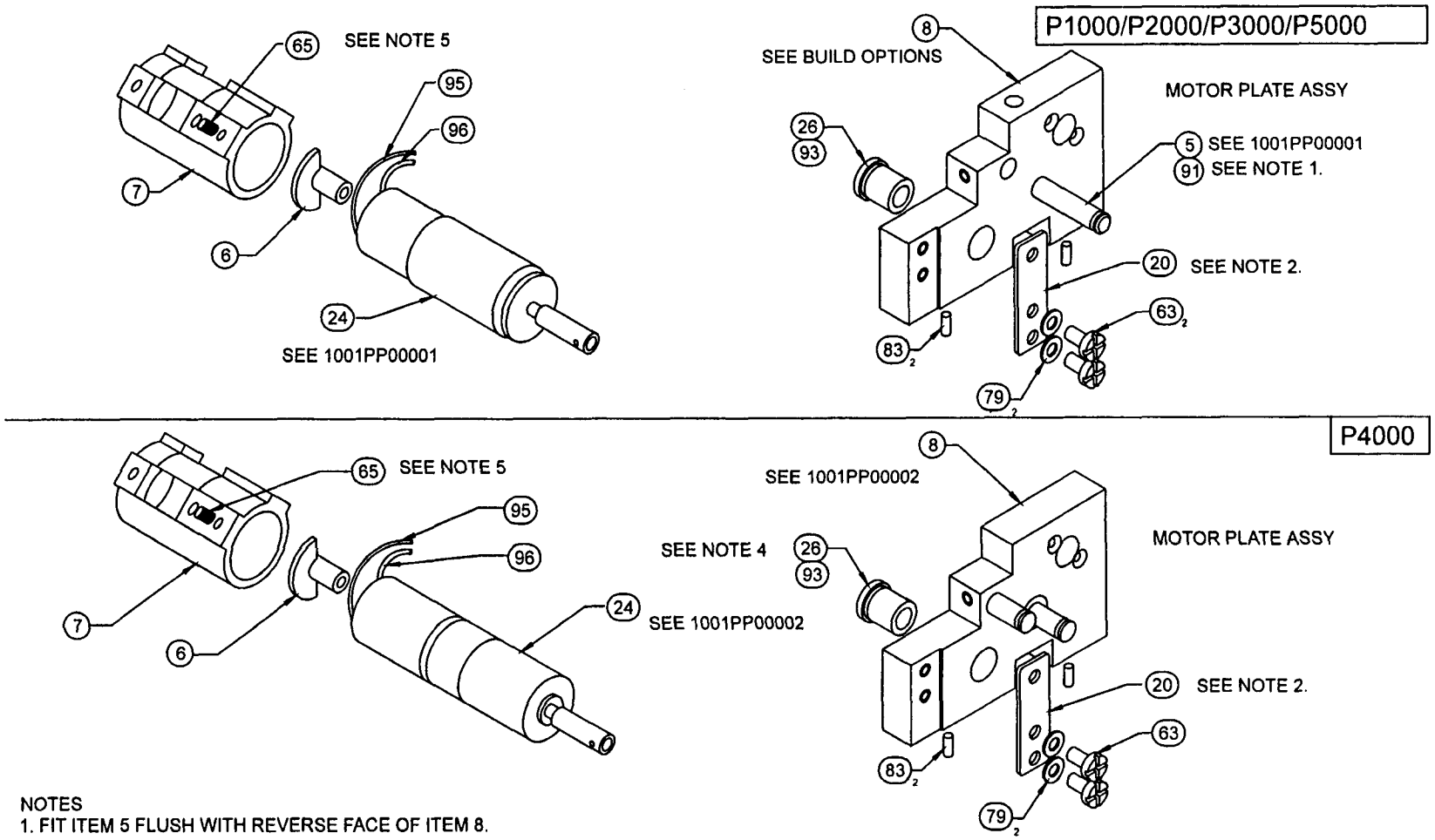
NOTES
1. APPLY ITEM 92 TO ITEM 59 BEFORE ASSEMBLY OF THE MOTOR GEARBOX TO THE MOTOR PLATE. SECURE USING 2 HOLES ON MOTOR MARKED WITH RED PAINT.

P4000



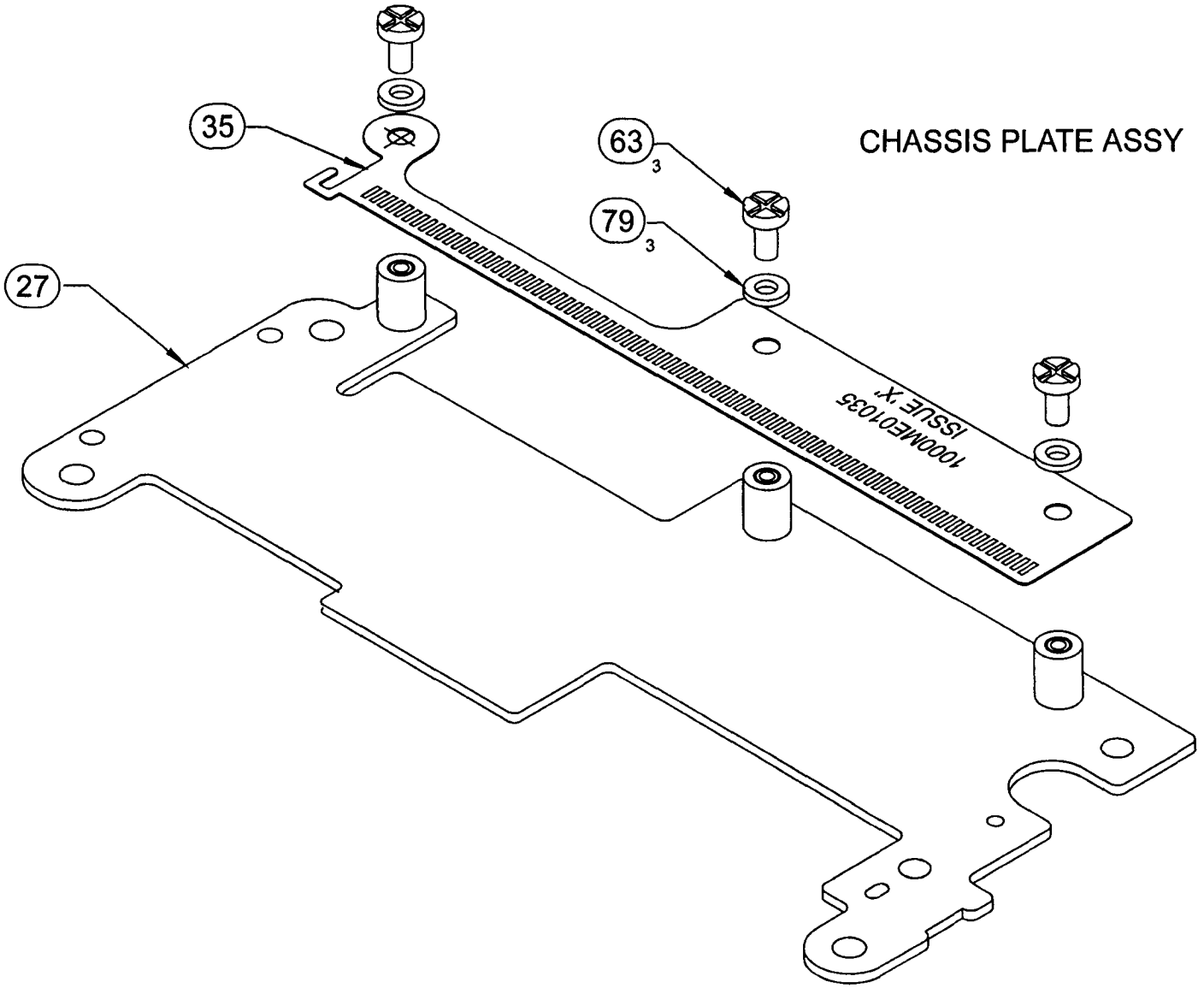
NOTES
2. APPLY ITEM 92 TO ITEM 59 BEFORE ASSEMBLY OF THE MOTOR GEARBOX TO THE MOTOR PLATE.

Transmission Assembly
(not issue controlled) 1001PP00004 Sheet 3



NOTES
1. FIT ITEM 5 FLUSH WITH REVERSE FACE OF ITEM 8.
2. FIT ITEM 20 SO EDGE IS PARALLEL AND FLUSH WITH LEDGE IN ITEM 8.
4. BOND ITEM 26 INTO ITEM 8 USING ITEM 93 ACCORDING TO PROCEDURE 0000PR00014.
5. FIT ITEM 65 INTO ITEM 7 APPLYING 25cNm OF TORQUE TO SECURE TO ITEM 24.

Transmission Assembly
(not issue controlled) 1001PP00004 Sheet 2



Transmission Assembly
(not issue controlled) 1001PP00004 Sheet 1

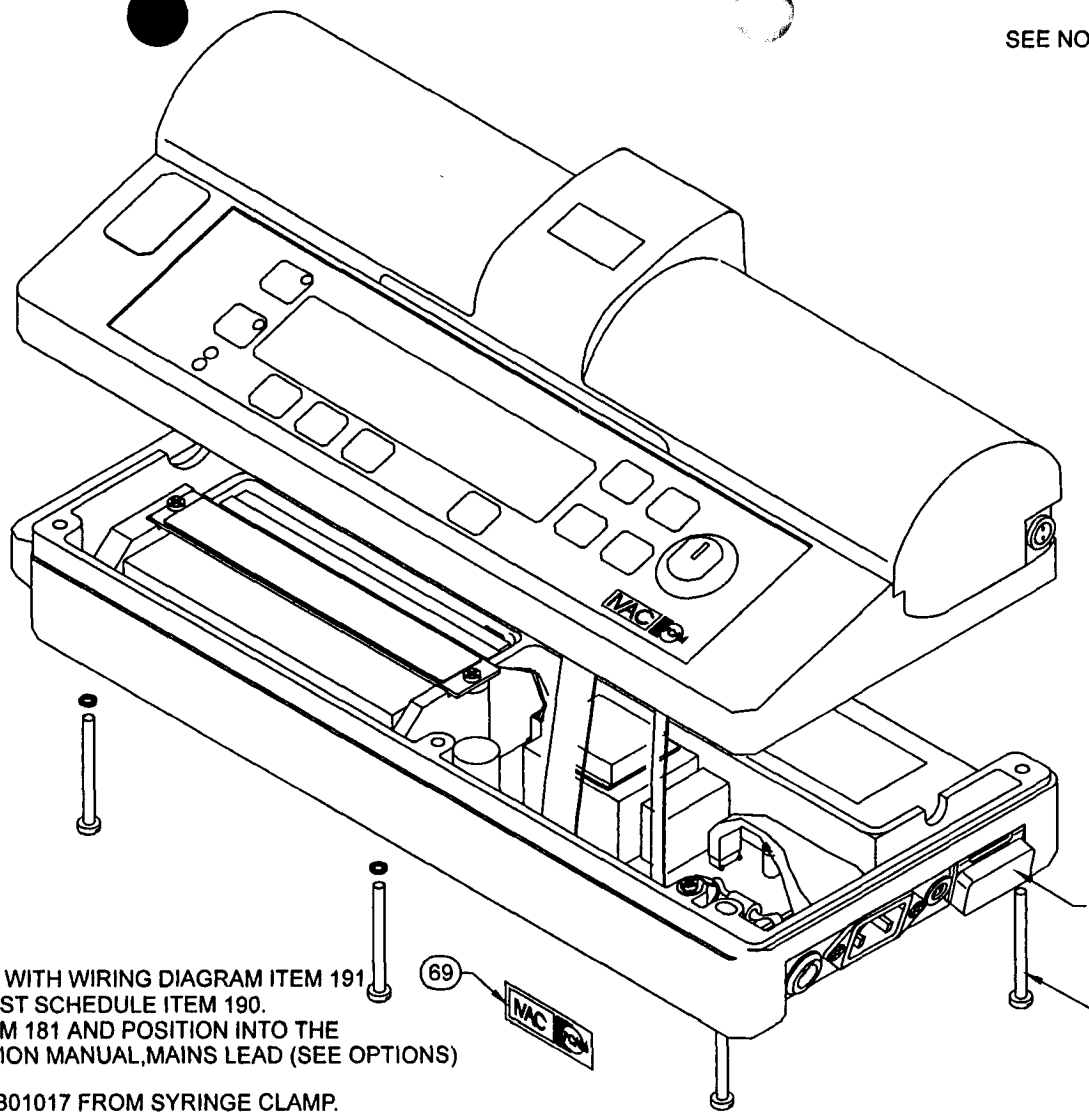
6.2 Transmission General Assembly 1001PP00004

See next sheets.

Item Number: 5000PP00001 P5000 KIT COMMON Iss: 51

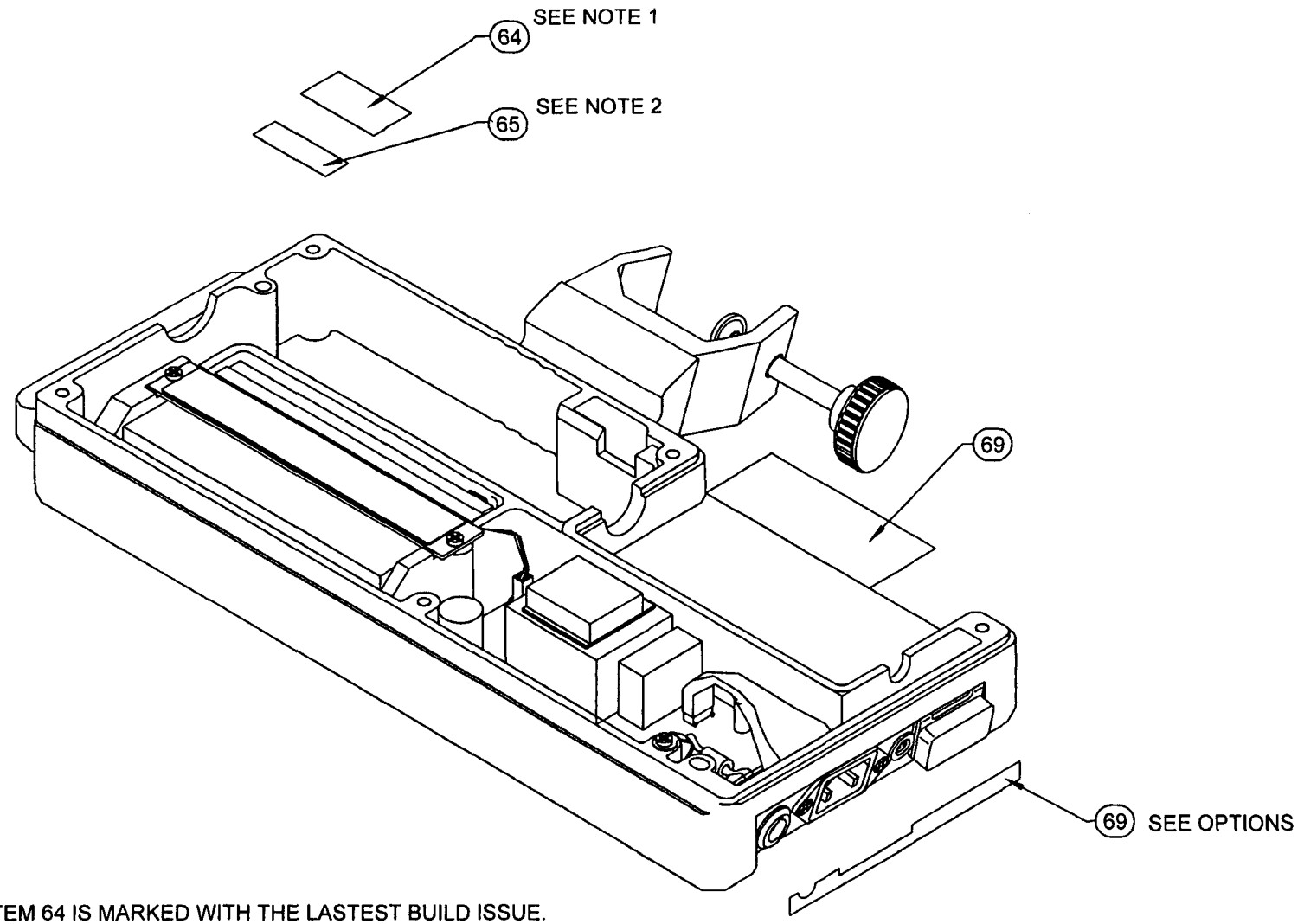
Part Number	Reference	Description	Qty
1001PP00004		V4 TRANS KIT COMMON	1.0
5000ME00067	1	CASE LOWER P5 HARD TOOL	1.0
5000ME00068	2	CASE UPPER P5 HARD TOOL	1.0
1000ME01064	3	FOAM PAD BATTERY	1.0
1000ME01123	4	PLATE BATTERY RESTRAINT PUNCHED	1.0
1000ME01005	5	PLATE BASE RS232 V4	1.0
1000SP00076	6	ASSY POLE CLAMP 40MM SWAGED	1.0
1000ME01006	7	CLAMP SYRINGE MACH. V4	1.0
5000ME00078	8	SHAFT SYRINGE CLAMP P500 0	1.0
1000ME01051	9	ALARM TUBE V4	1.0
5000ME00072	13	SPACER BUTTON F/P CLIPON	10.0
0000ME00141	14	STUD PE CONNECTOR M6 THREAD	1.0
1000SP01005	19	ASSY ALARM AUDIBLE	1.0
5000SP00027	21	ASSY HANDSET MK2 INLET	1.0
5000ME00055	23	SPEC MECHANICAL LOCK	1.0
5000ME00012	24	PLATE LOCK CAM	1.0
5000ME00074	25	ROD SUPPORT	1.0
5000ME00031	26	LATCH CAM	1.0
5000ME00032	27	ROD	1.0
0000ME00186	28	WASHER 13.5 X 9.61 X 0.5 NYLON	1.0
0000ME00188	29	WASHER 18.35 X 15.91 X 0 .75 NYLON	1.0
5000ME00081	30	WASHER KEYSWITCH SEALING	1.0
5000ME00054	31	SPEC KEYSWITCH	1.0
5000SP00001	32	ASSY KEYSWITCH	1.0
5000ME00088	33	LOCK SEAL BODY P5000	1.0
5000ME00089	34	LOCK SEAL SPINDLE P5000	1.0
5000ME00090	35	LOCK SEALING NUT P5000	1.0
5000ME00096	37	SLEEVE COVER HINGE	2.0
5000ME00094	39	MOULDING MAGNET/CATCH	1.0
5000ME00095	40	MOULDING BODY SPRING MEC HANISM	1.0
5000ME00099	41	COVER MOULDED PCAM	1.0
5000ME00052	42	ARM SPRING	1.0
5000ME00053	43	PLATE SPRING	1.0
0000ME00156	44	COVER MAGNET LATCH	1.0
0000ME00183	45	SPRING COMPRESSION	1.0
0000ME00110	46	SPRING COMP OD 7.62 44 LONG	1.0
0000ME00170	47	SPRING EXTENSION	1.0
0000ME00169	48	SPRING EXTENSION	1.0
5000ME00008	49	WINDOW DISPLAY	1.0
1000LB00102	64	LABEL COMB SERIAL\STATUS	1.0
5000LB00020	69	LABEL SET P5000	1.0
5000ME00066	70	LABEL COVER SPRING ARM BUFFER	1.0
0000ME00118	72	LABEL "READ BEFORE OPERATING"	1.0
1000LB00016	73	LABEL BASE PANEL 30x30	1.0
0000ME00268	79	SCREW M3x8 CSK HD POSI STAINLESS STEEL	4.0
0000ME00221	80	SCREW M3x6 PAN HD POSI ZP+P	5.0
0000ME00222	81	SCREW M3x6 CSK HD POSI 1 Z+BLACK	2.0
0000ME00189	82	SCREW M3x12 POZI HD Z+C	9.0
0000ME00255	84	SCREW M4x20 CSK HD POSI STAINLESS STEEL	2.0
0000ME00225	85	SCREW M4x40 PAN HD POSI 2 ZP+P	1.0
0000ME00224	86	SCREW M4x45 PAN HD POSI ZP+P	6.0
0000ME00164	87	SCREW M2x3 CSK HD SLOTTE D	2.0
0000ME00227	88	SCREW M4x16 PAN HD POSI 2 ZP+P	3.0
0000ME00246	89	SCREW M4x8 PAN HD POSI	3.0
0000ME00157	90	SCREW M4x12 CSK SNAKE EYE	2.0
0000ME00009	91	SCREW M3x5 CSK SET CUP	3.0
0000ME00011	93	SCREW No4 X 1/4" PAN HD	1.0
0000ME00230	94	SCREW M3x8 CSK HD POSI Z+BLACK	2.0
0000ME00015	100	WASHER M3 WAVEY SST	4.0
0000ME00048	101	WASHER M3 PLAIN Z+C	2.0
0000ME00045	103	WASHER M4 WAVEY SST	10.0
0000ME00286	104	WASHER M4 SHAKEPROOF	3.0
0000ME00278	105	PIN DOWEL M2X10 H&G	1.0
1000ME01087	110	CORD SEALING SILICONE INTERNAL BORE 0.95DIA	2.0
0000ME00026	111	FOOT SELF ADHESIVE V4	4.0
0000ME00102	112	DISC DOUBLE SIDED TAPE	1.0
0000ME00257	120	PIN TENSION 3.0x10.0	1.0
0000ME00116	122	PIN TENSION DIA 3.0x16mm	1.0
0000ME00112	130	CIRCLIP	2.0
0000ME00002	131	CIRCLIP E TYPE SHAFT DIA 4.8	1.0
0000ME00163	132	CIRCLIP E TYPE DIN 6799	1.0
1000ME01047	140	SEAL RING OUTER TUBE	1.0
0000ME00161	141	O RING 4.47 I/D x 1.78	1.0
0000ME00256	142	O RING 15.10 X 1.60	1.0
0000ME00160	143	O RING 3.0 I/D x 1.5	1.0
0000ME00051	156	ADHESIVE LOCTITE 242	0.05
0000ME00058	157	GREASE SILICONE	0.05
1000ME01074	170	GASKET MAINS INLET V4	1.0
1000SP00009	171	ASSY CABLE BATTERY	1.0
0000EL00004	172	BATTERY 6V NP2.8-6 RECHARGE	1.0
1000SP01001	173	ASSY INLET MAINS CONN	1.0
5000ME00042	180	PACKAGING SPEC. P5000	1.0
0000ME00062	181	BAG POLYTHENE 20" X 15"	1.0
0000ME00063	182	TAPE ADHESIVE PACKAGING	1.0
5000PR00001	190	SCHEDULE TEST P5000	1.0
5000EL00042	191	DIAGRAM WIRING P5000	1.0
1000ME00175	200	ACTUATOR POT. MOULDED	1.0
1000ME00207	201	PLATE POTENTIOMETER PUNCHED	1.0
1000SP01017	202	ASSY POTENTIOMETER 50K	1.0
1000LB01017	203	LABEL PROTECTIVE PLUNGER	1.0

SEE NOTES 1,2,3 AND 4.



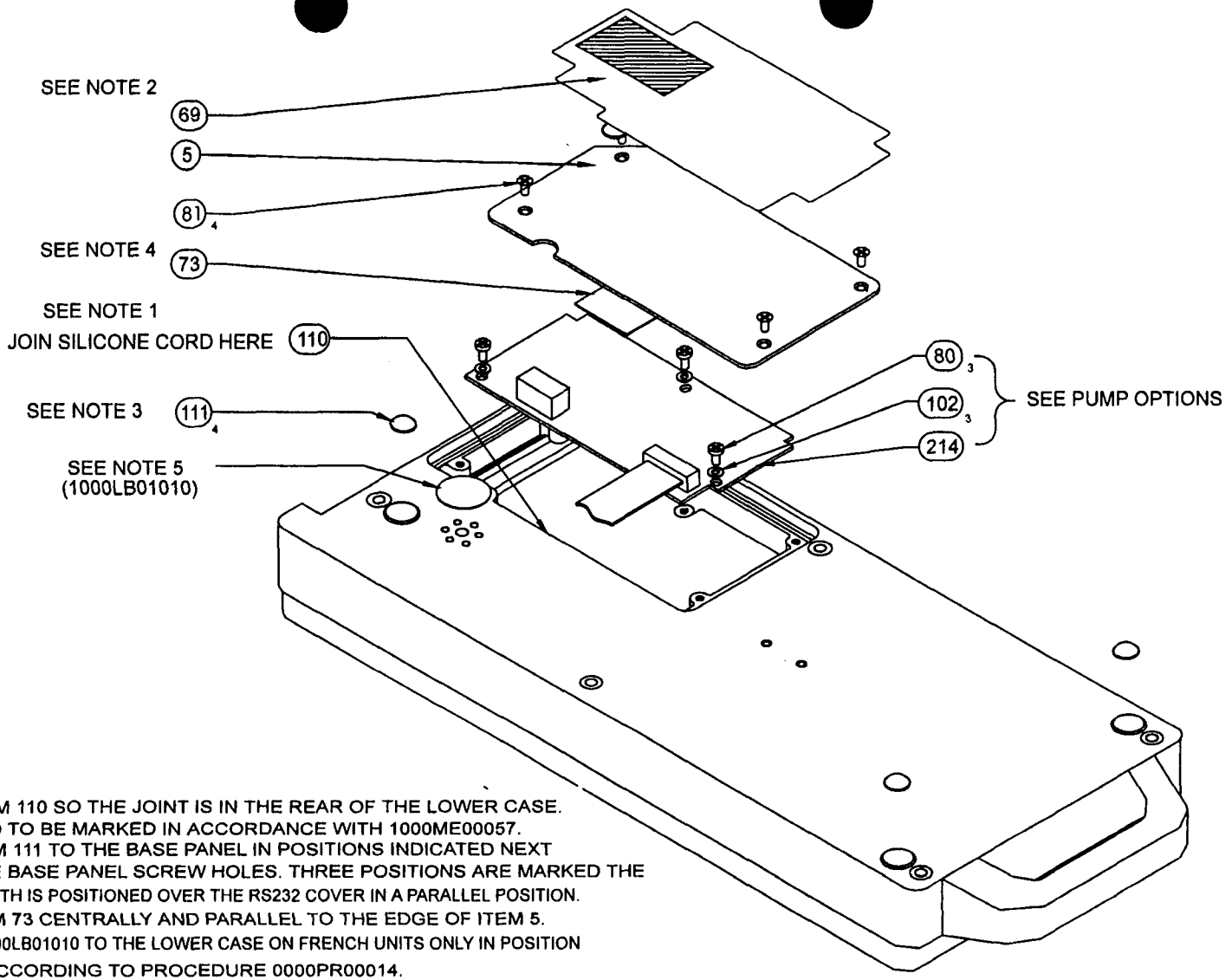
NOTES
1. UNIT TO BE WIRED IN ACCORDANCE WITH WIRING DIAGRAM ITEM 191.
2. TEST IN ACCORDANCE WITH THE TEST SCHEDULE ITEM 190.
3. PLACE FULLY TESTED UNIT INTO ITEM 181 AND POSITION INTO THE PACKAGING ALONG WITH INSTRUCTION MANUAL,MAINS LEAD (SEE OPTIONS) AND SEAL CARTON USING ITEM 182.
4. REMOVE PROTECTIVE LABEL 1000LB01017 FROM SYRINGE CLAMP.

Pump Syringe Assembly
(not issue controlled) 5000PP00001 Sheet 9



NOTES
1. ENSURE THAT ITEM 64 IS MARKED WITH THE LASTEST BUILD ISSUE. MARK WITH UPDATES AS NECESSARY.
2. ENSURE THAT ITEM 65 IS MARKED WITH THE UNIT SERIAL NUMBER IN ACCORDANCE WITH THE DEVICE HISTORY FILE.

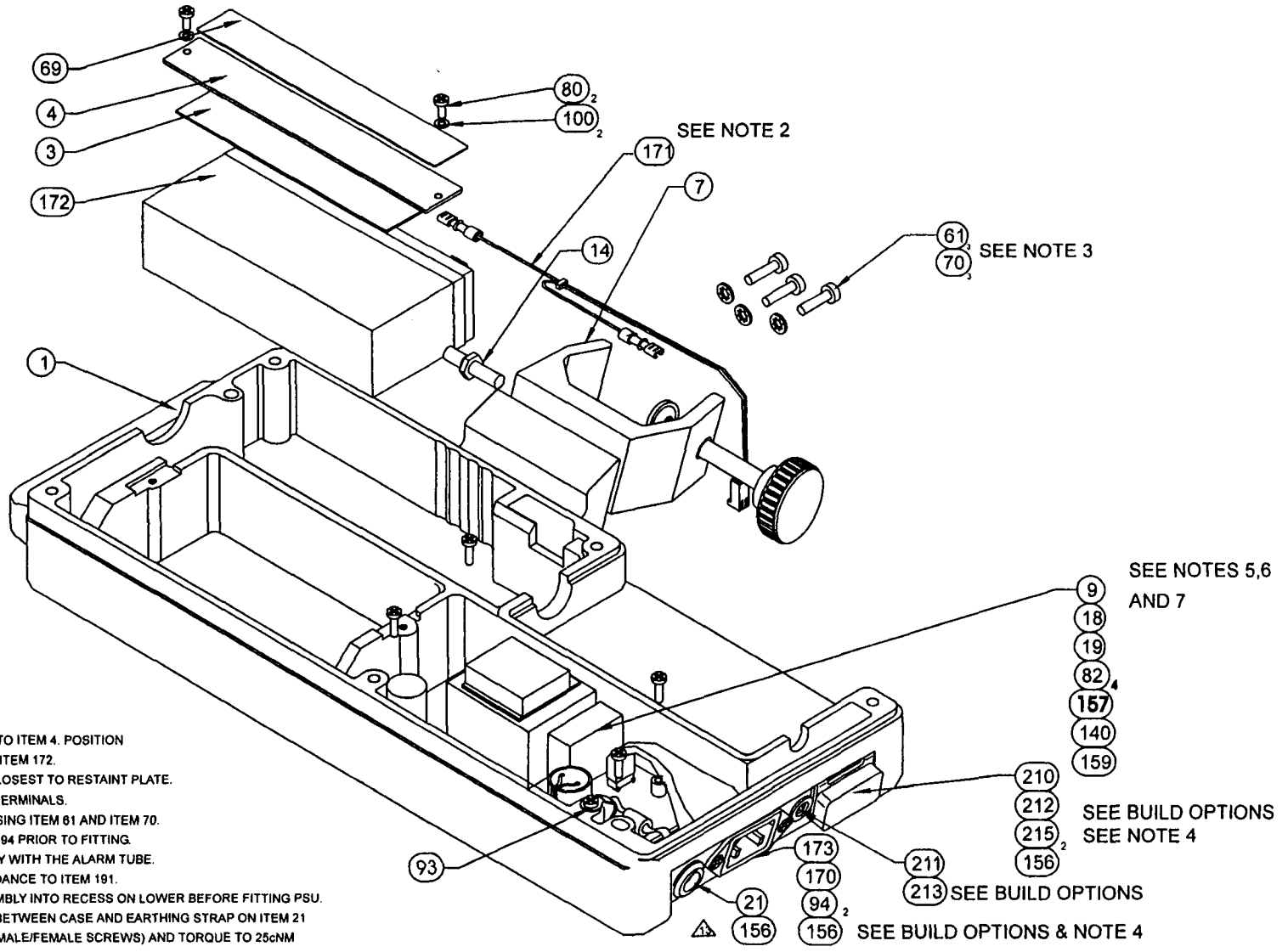
Pump Syringe Assembly
(not issue controlled) 5000PP00001 Sheet 8



NOTES

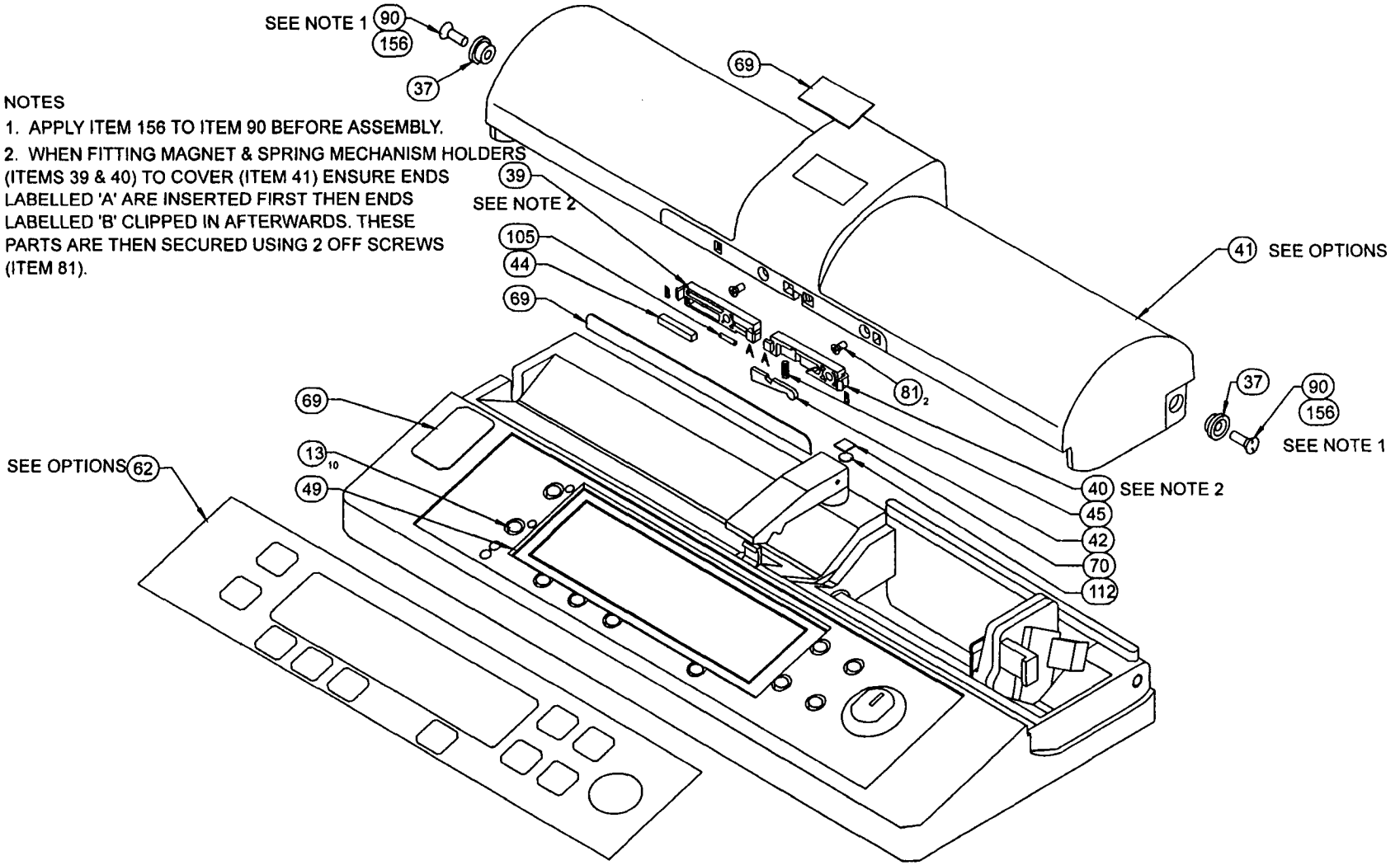
1. FIT ITEM 110 SO THE JOINT IS IN THE REAR OF THE LOWER CASE.
2. ITEM 69 TO BE MARKED IN ACCORDANCE WITH 1000ME00057.
3. FIT ITEM 111 TO THE BASE PANEL IN POSITIONS INDICATED NEXT TO THE BASE PANEL SCREW HOLES. THREE POSITIONS ARE MARKED THE THE FORTH IS POSITIONED OVER THE RS232 COVER IN A PARALLEL POSITION.
4. FIT ITEM 73 CENTRALLY AND PARALLEL TO THE EDGE OF ITEM 5.
5. BOND 1000LB01010 TO THE LOWER CASE ON FRENCH UNITS ONLY IN POSITION SHOWN ACCORDING TO PROCEDURE 0000PR00014.

Pump Syringe Assembly
(not issue controlled) 5000PP00001 Sheet 7

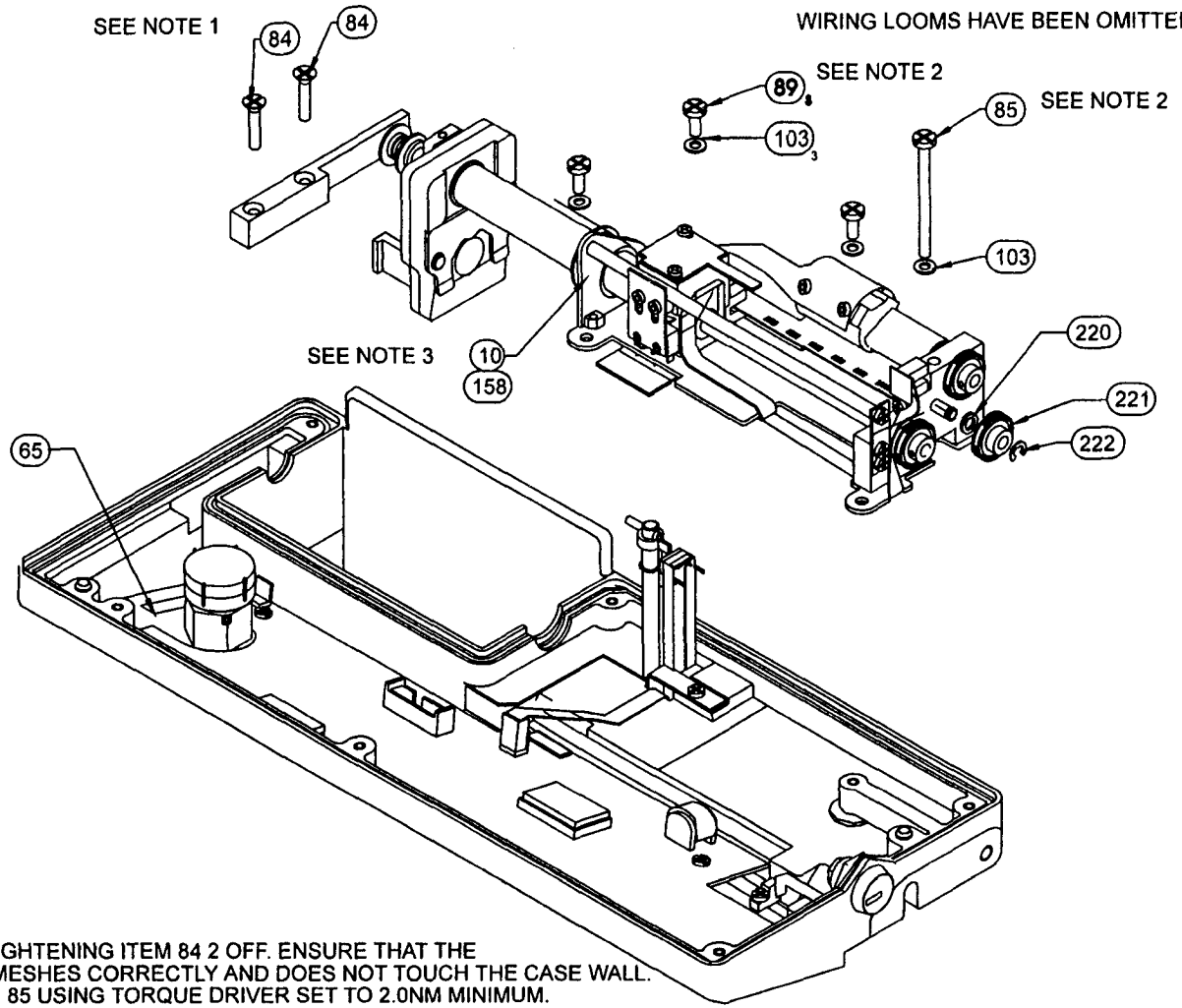


NOTES
1. TO FIT ITEM 172,BOND ITEM 3 TO ITEM 4. POSITION ITEM 172 IN ITEM 1 AND SECURE ITEM 172.
2. BATTERY TERMINALS TO BE CLOSEST TO RESTAINT PLATE. ROUTE BATTERY LOOM UNDER TERMINALS.
3. FIT POLE CLAMP ASSEMBLY USING ITEM 61 AND ITEM 70.
4. APPLY ITEM 156 TO ITEM 215 & 94 PRIOR TO FITTING.
5. INVERT ITEM 140 ON ASSEMBLY WITH THE ALARM TUBE.
6. UNIT TO BE WIRED IN ACCORDANCE TO ITEM 191.
7. FIT COMPLETED ALARM ASSEMBLY INTO RECESS ON LOWER BEFORE FITTING PSU.
8. STAR WASHER TO BE FITTED BETWEEN CASE AND EARTHING STRAP ON ITEM 21
9. APPLY ITEM 156 TO ITEM 215 (MALE/FEMALE SCREWS) AND TORQUE TO 25cNM

Pump Syringe Assembly
(not issue controlled) 5000PP00001 Sheet 6



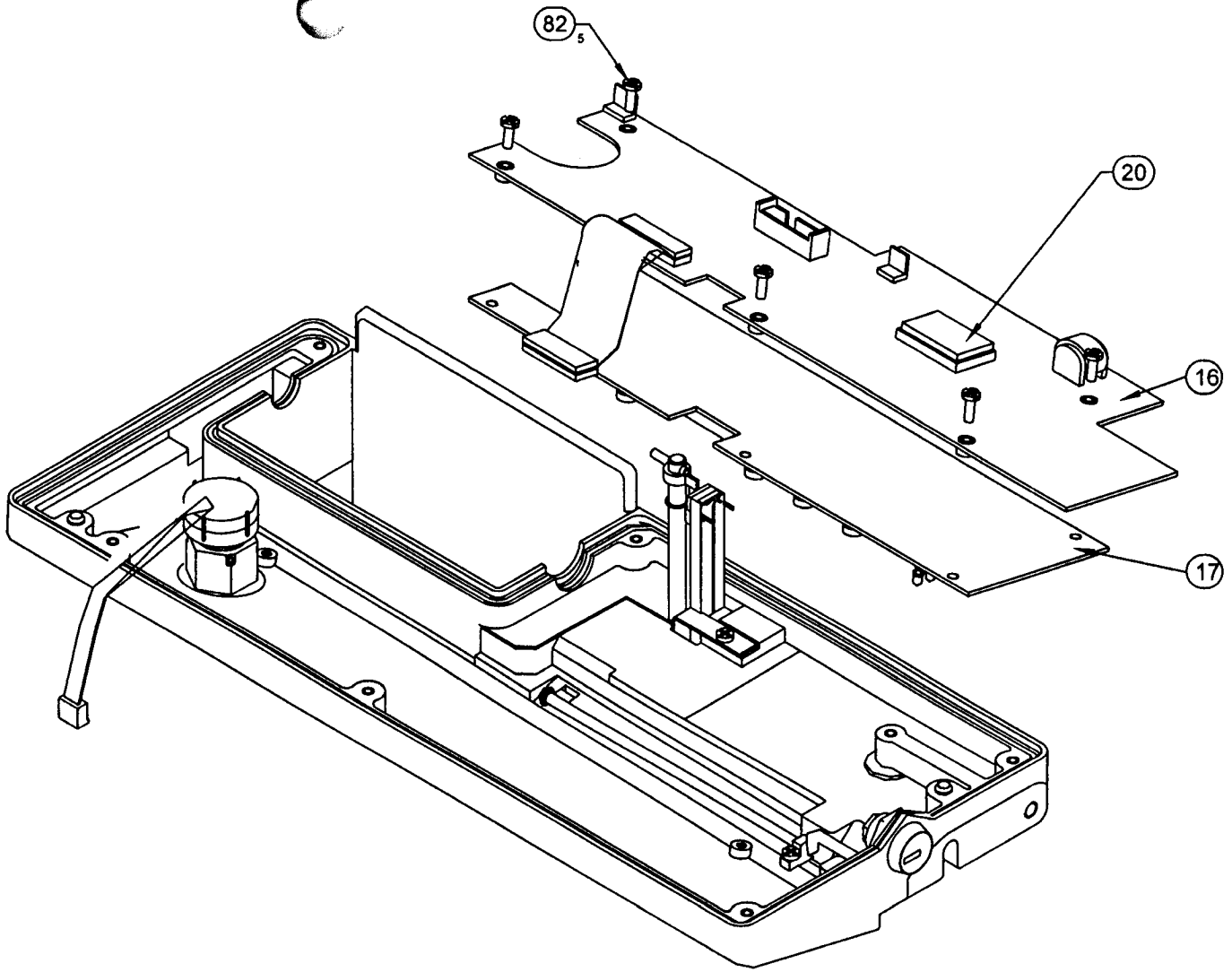
Pump Syringe Assembly
(not issue controlled) 5000PP00001 Sheet 5



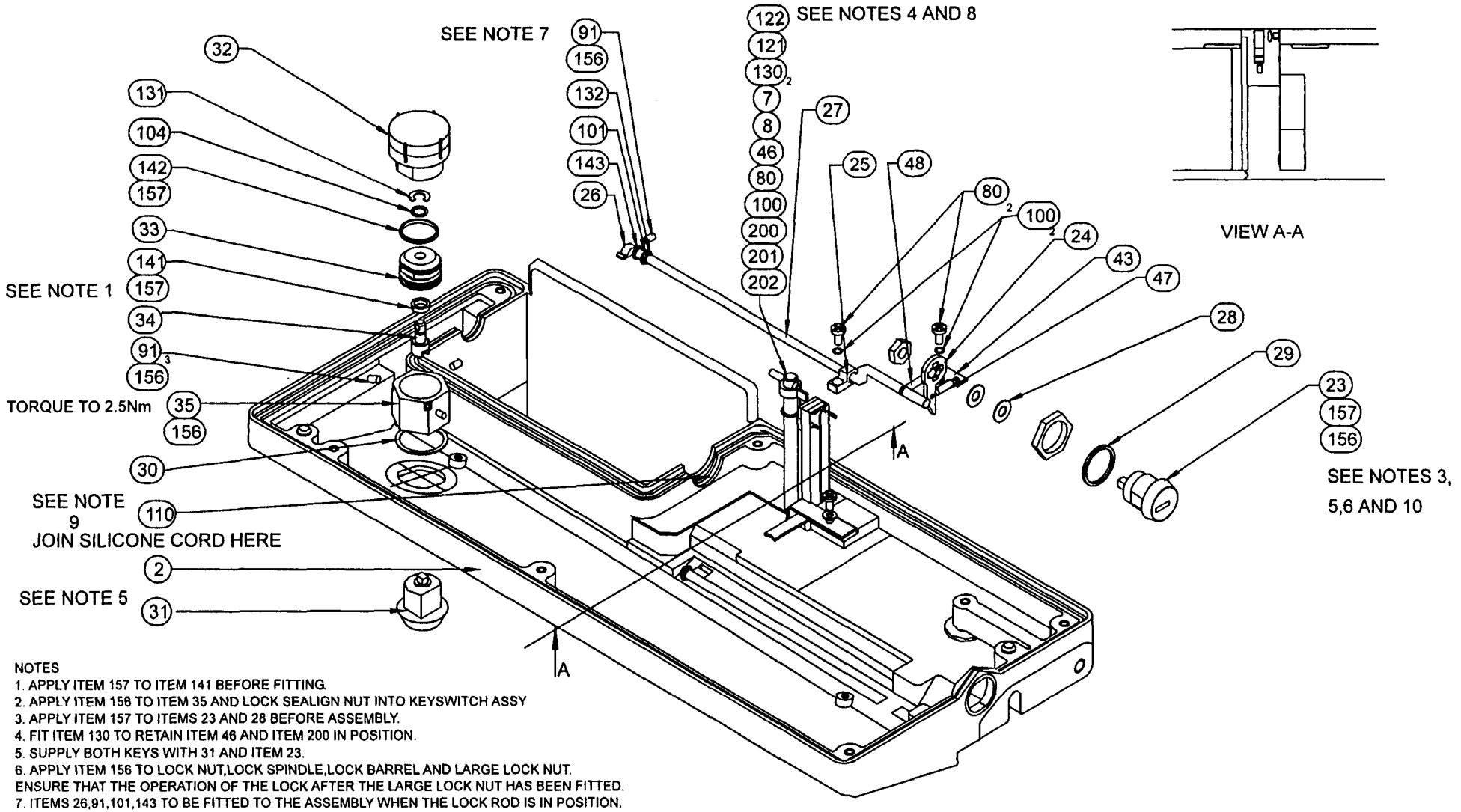
NOTES

1. POSITION BEAM BEFORE TIGHTENING ITEM 84 2 OFF. ENSURE THAT THE LEADSCREW DRIVE GEAR MESHES CORRECTLY AND DOES NOT TOUCH THE CASE WALL.
2. TIGHTEN ITEM 89 AND ITEM 85 USING TORQUE DRIVER SET TO 2.0NM MINIMUM.
3. APPLY ITEM 158 TO THE THREAD OF THE LEADSCREW WHILST RUNNING IN. REMOVE EXCESS GREASE. AVIOD CONTACT WITH SKIN OR ANY OTHER PART OF THE ASSEMBLY.

Pump Syringe Assembly
(not issue controlled) 5000PP00001 Sheet 4

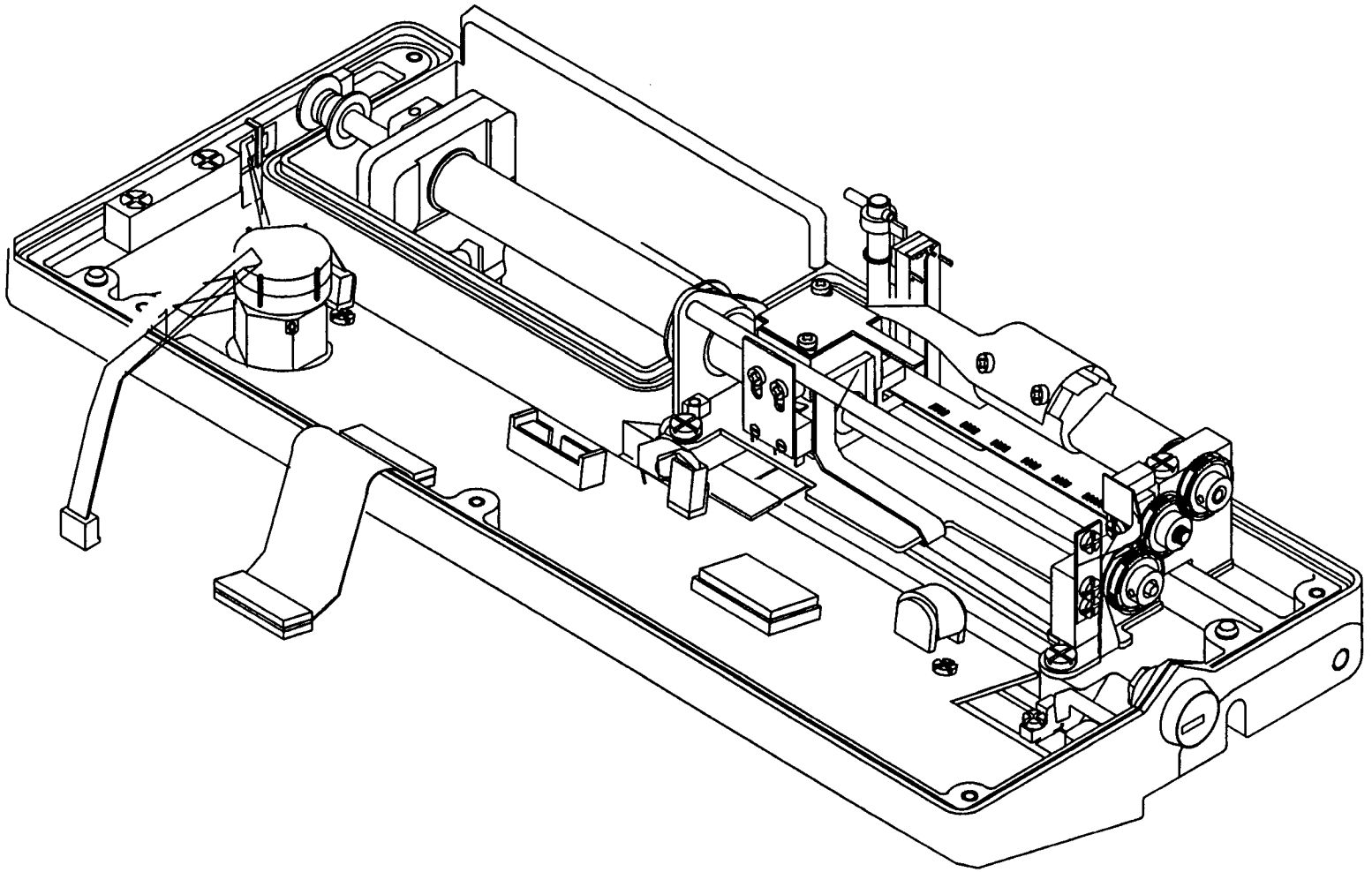


Pump Syringe Assembly
(not issue controlled) 5000PP00001 Sheet 3



NOTES
1. APPLY ITEM 157 TO ITEM 141 BEFORE FITTING.
2. APPLY ITEM 156 TO ITEM 35 AND LOCK SEALIGN NUT INTO KEYSWITCH ASSY
3. APPLY ITEM 157 TO ITEMS 23 AND 28 BEFORE ASSEMBLY.
4. FIT ITEM 130 TO RETAIN ITEM 46 AND ITEM 200 IN POSITION.
5. SUPPLY BOTH KEYS WITH 31 AND ITEM 23.
6. APPLY ITEM 156 TO LOCK NUT,LOCK SPINDLE,LOCK BARREL AND LARGE LOCK NUT.
ENSURE THAT THE OPERATION OF THE LOCK AFTER THE LARGE LOCK NUT HAS BEEN FITTED.
7. ITEMS 26,91,101,143 TO BE FITTED TO THE ASSEMBLY WHEN THE LOCK ROD IS IN POSITION.
8. ENSURE THAT THE GAP BETWEEN ITEM 200 AND ITEM 202 IS 1mm WHEN ASSEMBLED.
FIT ITEM 122 ENSURING IT PROTUDES BY 2mm IN THE ORIENATION SHOWN.
9. ITEM 110 TO BE FITTED IN SUCH A WAY THAT THE JOINTS ARE IN THE LEAST VULNERABLE PLACE.
10. ENSURE THAT ITEM 23 WHEN ASSEMBLED IS NOT TO TIGHT.
11. ADD PROTECTIVE LABEL 1000LB01017 TO SYRINGE CLAMP.

Pump Syringe Assembly
(not issue controlled) 5000PP00001 Sheet 2



Pump Syringe Assembly
(not issue controlled) 5000PP00001 Sheet 1

6.0 MECHANICAL ASSEMBLY DRAWINGS AND PARTS LISTS

6.1 Pump Syringe Assembly 5000PP00001

See next sheets.

7.0 DISASSEMBLY, COMPONENT REPLACEMENT AND ASSEMBLY

7.1 5000PB00008 - Fitting Instructions for Front Panel Label
7.2 5000PB00020 - Fitting Instructions Case Upper P5000
7.3 5000PB00009 - Fitting Instructions Motor Gearbox Assembly
7.4 5000PB00030 - Fitting Instructions Control Assembly P5000
7.5 5000PB00031 - Fitting Instructions Linear Grid P5000
7.6 5000PB00021 - Fitting Instructions Spares Kit Lower Case P5000
7.7 5000PB00032 - Fitting Instructions Power PCB Assembly P5000
7.8 5000PB00033 - Fitting Instructions Battery P5000
7.9 5000PB00034 - Fitting Instructions Mains Fuse P5000
7.10 5000PB00040 - Fitting Instructions Cover P5000
7.11 5000PB00036 - Fitting Instructions Cover Lock P5000
7.12 5000PB00037 - Fitting Instructions Handset Connector P5000
7.13 5000PB00042 - Fitting Instructions Transmission Assembly.
7.14 5000PB00043 - Fitting Instructions Display Board.

7.1 5000PB00008 ISSUE 1

Fitting Instructions for Front Panel Label

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 5000PB00004 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cable Part No. 5000JG00001.

1.0 Introduction

The Front panel label provides a seal against fluid ingress protecting the pump from possible malfunction. Therefore it should be replaced if it is damaged in a way which affects its integrity.

2.0 Access to the Pump (follow this section only if required)

2.1 Place the unit on a static dissipative surface that is correctly grounded.
2.2 Remove the six case retaining screws (M4 x 45mm pan head) located on the base of the unit and withdraw the base plate.
2.3 Carefully separate the upper and lower case halves and disconnect the grey ribbon cable from the socket on the power supply PCB.

7.1 5000PB00008 ISSUE 1 (CONT)

3.0 Fitting Instructions

3.1 It should not be necessary to open the pump to replace the front panel. However if fluid ingress is suspected it is important to check that no corrosion or damage has occurred inside the pump (for access to the pump see section 2 of this instruction).

3.2 Using a sharp edge or scalpel blade, lift one corner of the panel and carefully peel back to remove the panel and adhesive backing. This will also remove the clear perspex window.

3.3 Clean the surface of the upper case thoroughly with isopropyl alcohol to remove any residual adhesive and dirt, leaving a clean degreased surface.

3.4 Ensure that the button spacers are correctly situated in the case on the display board.

3.5 Place the new window and the new panel into case recesses, ensuring that the label is the correct size. Trim to fit if necessary (recommend 0.5 mm gap at both sides).

3.6 Before removing adhesive backing, test that all switches operate correctly.

3.7 Starting from the left hand edge, peel backing off and press new panel in place. Take care to align the panel in the recess, since once it is fitted it is difficult to remove without damage.

3.8 Carefully test all buttons are functioning correctly prior to returning pump into service.

4.0 Technical Inquiries.

For additional technical assistance, contact your local ALARIS Service Operations.

7.2 5000PB00020 ISSUE 3

Fitting Instructions Case Upper P5000

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 5000PB0004 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

Always protect the plunger holder, cover and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. For regular servicing we recommend the use of the upper case support cradle Part No. 5000JG00001. This will avoid damaging the mechanism or the cover.

1.0 Introduction

This fitting instruction applies to P5000 units with build issues 46 and above.

This fitting instruction applies to the hard tooled upper case 5000ME00068.
The upper case 5000ME00002 has been superseded by 5000ME00068.
This modification has to be performed as a result of implementing the hard tooled P5000 cases.
To carry out the instructions listed below access to the upper case assembly is required.
This fitting instruction refers to the spares kit 5000SP00017.

7.2 5000PB00020 ISSUE 3

In addition to 5000SP00017 the appropriate front panel label will need to be purchased.

5000LB00002	**Label Front Panel P5000 English**
5000LB00005	**Label Front Panel P5000 French**
5000LB00006	**Label Front Panel P5000 German**

2.0 Access to the Pump

2.1 Place the unit on a static dissipative surface that is correctly grounded.
2.2 Remove the six case retaining screws (M4 x 45mm pan head) located on the base of the unit .
2.3 Carefully separate the upper and lower case halves and disconnect the cable assemblies between the power supply board and the control board assembly.

3.0 Fitting & Removal Instructions Upper Case

3.1.0 Remove the silicone sealing cord 1000ME01087.
3.1.1 Remove the two cover retaining screws, retain the screws and the cover for reassembly later.
3.1.2 Disconnect the beam and the flexible circuit from the control board assembly.
3.1.3 Remove the six transmission assembly retaining screws, retain these for refitting later.
3.1.4 Remove the transmission assembly from the upper case, taking care that the transmission is not damaged during this process. Retain the transmission assembly for refitting later.
3.1.5 Remove the five board retaining screws 0000ME00189 from the control board and display board assembly.
3.1.6 Remove the control board 5000EL00055 and display board 5000EL00037 assembly from the upper case assembly.

Syringe Sizing Potentiometer assembly

3.1.7 Remove the securing pin 0000ME00116 from the syringe shaft assembly, retain the pin from the assembly, see figure 1 for further information.
3.1.8 Remove the potentiometer actuator 1000ME00175 from the syringe shaft assembly, retain this for refitting later. See figure 1 for further information.

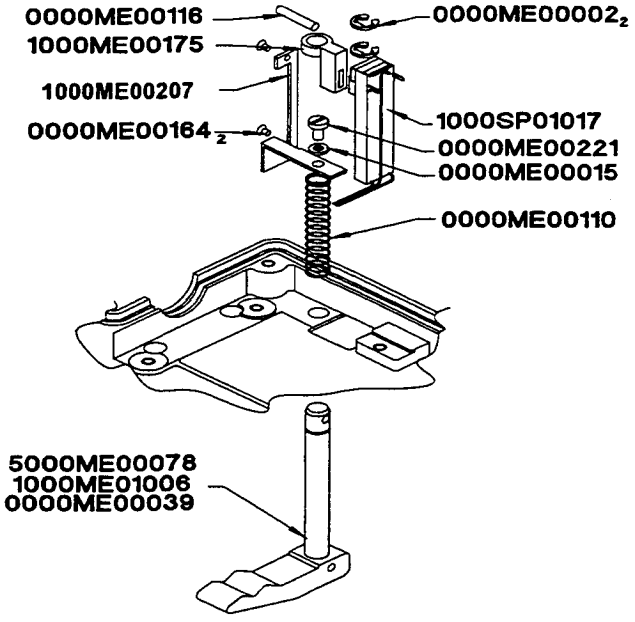
7.2 5000PB00020 ISSUE 3

3.1.9 Remove the screw 0000ME00221 and washer 0000ME00015 securing the potentiometer assembly from the upper case, retain the screw, washer and potentiometer assembly for refitting later. See figure 1 for further information.

3.1.10 Remove the circlips 0000ME00002 retaining the spring from the syringe shaft assembly, retain the circlips and the spring for refitting later. See figure 1 for further information.

3.1.11 Remove the syringe shaft assembly from the upper case assembly.

Figure 1.



Cover Lock assembly

3.1.12 Remove the retaining screw 0000ME00009 from the cover lever fitted to the reverse of the upper case, retain the retaining grub screw and the lever 5000ME00031 for reassembly later. See figure 2 for future information.

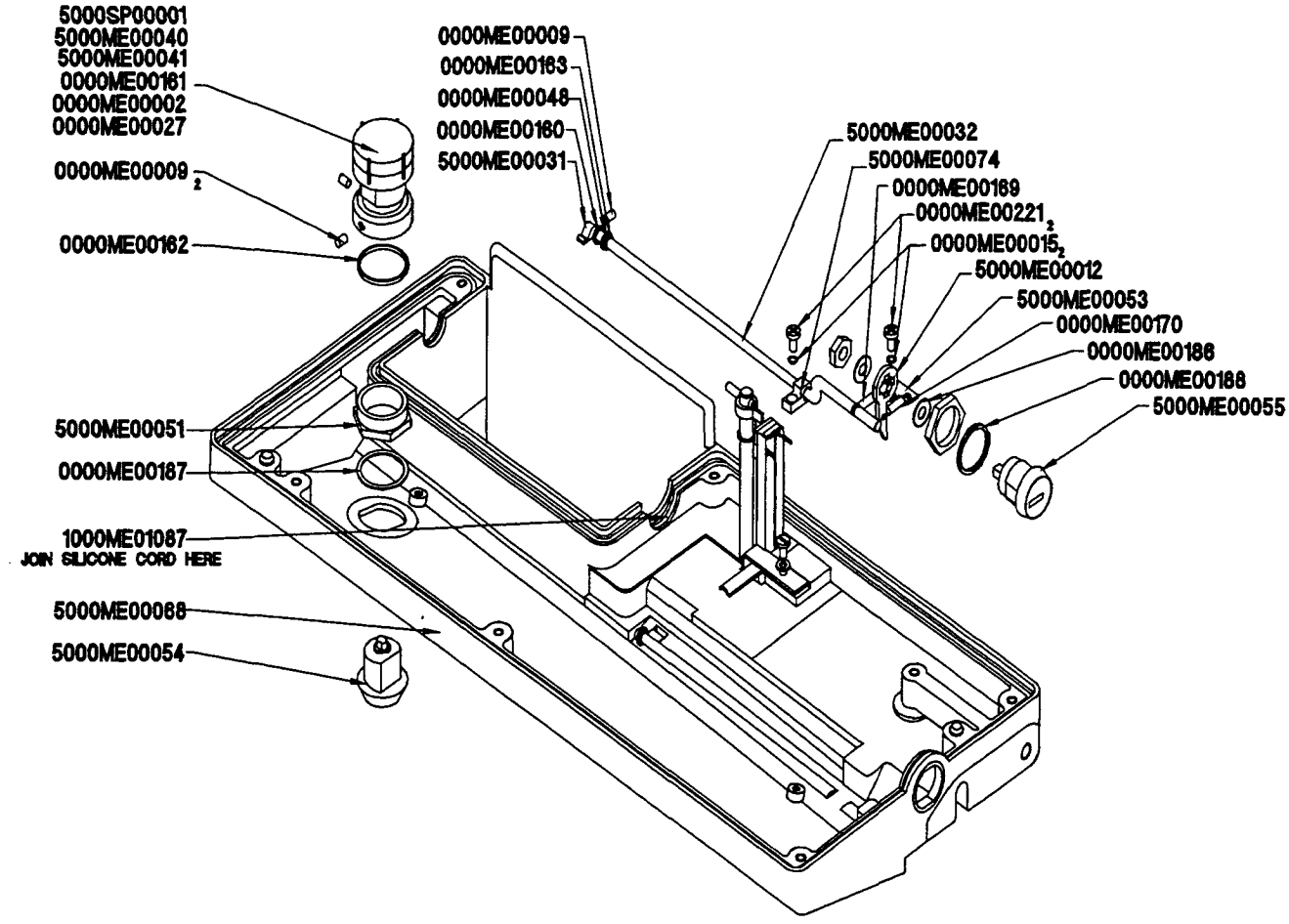
3.1.13 Remove the retaining screws 0000ME00221 from the rod support and the spring plate and keep these for refitting later. See figure 2 for further information.

3.1.14 Disconnect the spring 0000ME00170 fitted between the spring plate 5000ME00053 and the lock cam plate 5000ME00012, retain this for reassembly later. See figure 2 for further information.

7.2 5000PB00020 ISSUE 3

3.1.15 Remove the nut holding the lock to the upper case and remove the lock assembly from the upper case assembly. Keep the lock assembly, the lock mechanism and the sealing washer 0000ME00188 for refitting later. See figure 2 for further information.

Figure 2



Keyswitch assembly

3.1.16 Loosen the two lock body retaining screws 0000ME00009 so that the lock body assembly can be removed and retained for refitting. Remove the lock sealing washer 0000ME00187, the lock nut 5000ME00051 and lock assembly 5000ME00054 from the upper case assembly. Keep these for refitting later.

3.1.17 Remove the lock securing nut 5000ME00051 from the lock assembly. Remove the lock 5000ME00054, sealing washer 0000ME00187 and securing nut 5000ME00051 from the upper case assembly. Keep these for refitting later.

7.2 5000PB00020 ISSUE 3

Display Window

3.1.18 Remove the front panel label.
3.1.19 Remove the display window 5000ME00008 and keep this for refitting later. Ensure that the display window is not damaged during removal, as the window is fragile.

3.2 Fitting the new Upper Case

3.2.0 Refit the silicone sealing cord 1000ME01087. See figure 2 for further information

Keyswitch assembly

3.2.1 Fit the lock assembly into the new upper case supplied 5000ME00068, fit the lock assembly 5000ME00054 and sealing washer 0000ME0187, secure with the lock nut 5000ME00051. See figure 2 for further information.
3.2.2 Test for the correct operation of the lock assembly after tightening the securing nut.
3.2.3 Fit the keyswitch assembly, ensuring the groove in the lock assembly locates correctly into the lock spindle 5000ME00041. Refit the two lock body securing screws 0000ME00009. See figure 2 for further information.
3.2.4 Test the correct operation of the complete keyswitch assembly.

Cover Lock assembly

3.2.5 Fit the lock assembly 5000ME00055 and the sealing washer 0000ME00188 before securing with the lock nut.
3.2.6 Fit the rod assembly into the upper case. Ensure that the rod support is located correctly.
3.2.7 Fit the securing screws 0000ME00221 and washers 0000ME00015 to the spring plate 5000ME00053 and rod support 5000ME00074.
3.2.8 Fit the spring 0000ME00170 between the spring plate 5000ME00053 and the lock cam plate 5000ME00012.
3.2.9 Fit the cover latch and the securing screw to the reverse of the upper case assembly.
3.2.10 Test the cover lock to ensure the correct operation of the assembly.

Syringe Sizing Potentiometer assembly

3.2.11 Fit the syringe clamp assembly into the upper case, fit the spring 0000ME00110 and retain the spring with two circlips remove earlier 0000ME00002. See figure 1 for further information.

3.2.12 Fit the potentiometer assembly 1000SP01017 and secure with the screw and washer kept from earlier 0000ME00221 and 0000ME00015. See figure 1 for further information.

3.2.13 Fit the potentiometer actuator 1000ME00175 and secure with the pin 0000ME00116. See figure 1 for further information.

3.2.14 Test the syringe sizing potentiometer assembly to ensure the correct operation.

Transmission assembly

3.2.15 Fit the transmission assembly into the upper case, ensure that the seals are correctly located and the beam is positioned before securing using the six securing screws kept from earlier.

3.2.16 Transfer the information from the old serial number label to the label supplied and fit to the upper case.

Control Board and Display Board Assembly

3.2.17 Fit the control board and display board assembly into the upper case, secure the assembly with the fixing screws 0000ME00189 retained from earlier.

3.2.18 Connect the beam, transmission and power switch cable assemblies to the connectors on the control board.

4.0 Upper and Lower Case Assembly

4.1 Reconnect the cable assemblies between the control board and the power supply board.

4..2 Ensure that the cable assemblies are not trapped when the upper and lower case assemblies are fitted together.

4.3 Fit the six case fixing screws and washers retained from earlier.

4.4 Turn the unit over and refit the display window 5000ME00008, see figure 3 for further information.

4.5 Ensure that all the spacer buttons have been refitted, see figure 3 for more information. Ensure that the buttons operate correctly.

4.6 Ensure that the front panel recess in the upper case is clean and free from dust, before fitting the appropriate front panel label.

4.7 Fit the key operation label 5000LB00020, the position is shown in figure 3.

4.8 Fit the buffer label 5000ME00066 and the fixing disc 0000ME00102, the position is shown in figure 5.

4.9 Fit the cover assembly as shown in figure 3. Ensure the correct operation of the cover mechanism.

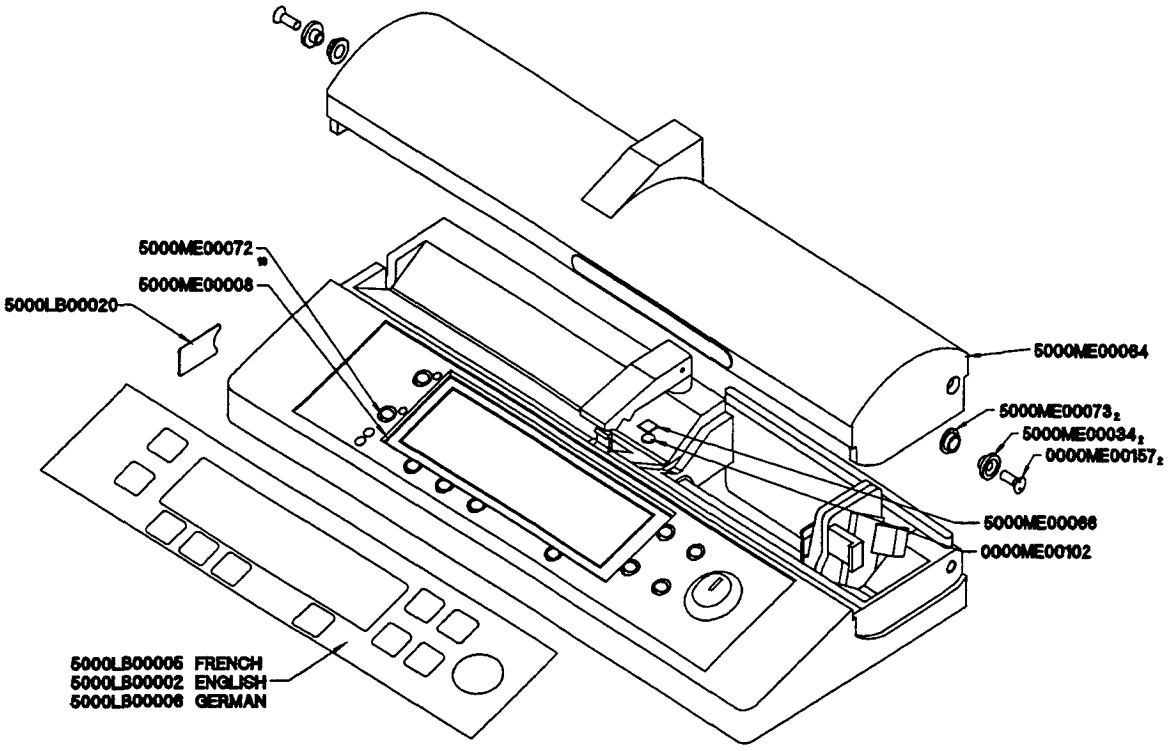
4.10 Fit the IVAC logo label 5000LB00020 to the lower case in the same position as the logo label on the old lower case.

7.2 5000PB00020 ISSUE 3

4.11 Connect the handset assembly and test the correct operation of the handset assembly.

4.12 Complete a self test routine as described in the technical service manual.

Figure 3.



5.0 Technical Inquiries.

For additional technical assistance, contact your local ALARIS Service Operations.

7.3 5000PB00009 ISSUE 1

Fitting Instructions Motor Gearbox Assembly

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 5000PB00004 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cable Part No. 5000JG00001.

1.0 Introduction

This instruction explains the fitting and removal of the motor gearbox assembly.

2.0 Access to the Pump

2.1 Place the unit on a static dissipative surface that is correctly grounded.
2.2 Remove the six case retaining screws (M4 x 45mm pan head) located on the base of the unit and withdraw the base plate.
2.3 Carefully separate the upper and lower case halves and disconnect the grey ribbon cable from the socket on the power supply PCB.

7.3 5000PB00009 ISSUE 1 (CONT)

3.0 Fitting Instructions

3.1 Remove the circlip and idler gear from the spigot on the motor mounting plate. Be careful to retain the M5 plain washer fitted behind the idler gear.

3.2 Position upper case assembly to enable the removal of the pin securing the gear to the gearbox output shaft. Support the gear, taking care not to damage the teeth and remove the pin.

3.3 Disconnect the flexible circuit from the motor by removing the four self-tapping screws (No. 4 x 1/4" ; 2 off and No. 4 x 3/8" ; 2 off) and de-soldering the two motor wires. Note that the two shorter screws are fitted nearest to the motor mounting plate.

3.4 Disassemble the motor/gearbox assembly from the motor mounting plate by removing the two fixing screws (M2 x 12 mm long).

3.5 Remove the encoder flag and opto mount and refit to replacement motor/gearbox assembly.

3.6 Fit replacement motor gearbox assembly to the motor mounting plate using the two fixing screws and secure in place by applying Loctite 221 to the ends of the screw threads.
Note that there are four holes in two sets of two, diagonally across the face of the gearbox. Use the two holes without the rings around them.

3.7 Solder the two motor wires to the flexible circuit with the black wire to the terminal marked '+'.
Secure the flexible circuit to the motor gearbox assembly using the four self tapping screws. Ensure that the two wires from the motor to the flexible circuit do not foul the encoder flag or it is likely that the motor will stall, producing an error code, '4 Too few or no motor encoders'.
Note on some units the different screw lengths - the shorter ¼" is fitted near to the motor and the longer 3/8" fitted furthest from the motor.
Also check that the encoder flag does not strike the opto switches as it rotates. Again this will produce an error code as above.

3.8 Refit the gear to the motor coupling re-using the spirol pin removed earlier.
Note : It is important to support the motor shaft whilst fitting the gear and it is recommended that the pin is pressed in using a vice in preference to being drifted into place with a hammer.
Avoid spinning the gear excessively. Rotate it slowly to check its free movement.

3.9 Refit the idler gear and circlip ensuring that the M5 plain washer is fitted in place behind the idler gear.

3.10 Re-assemble the upper and lower cases and carry out the self test routine to ensure the correct operation of the pump.

4.0 Technical Inquiries.

For additional technical assistance, contact your local ALARIS Service Operations.

7.4 5000PB00030 ISSUE 2

Fitting & Removal Instructions for Control Board Assembly P5000

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 5000PB00004 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 5000JG00001.

1.0 Introduction.

This instruction applies to all Control boards as fitted to all models of the P5000 Syringe Pumps.

2.0 Fitting & Removal Instructions.

2.1 Carefully disconnect flexible circuit (1000SP01040), beam assembly strain gauge connection (1000SP00003), potentiometer connection (0000EL00267) and Ground Tag (only on 5000EL00065) from board.
2.2 Remove the six mounting screws (0000ME00189). Retain screws and washers for board reassembly.
2.3 Withdraw control and display PCB Assemblies from unit.
2.4 Carefully disconnect control and display boards.
2.5 To fit a new control board assembly, connect the board to the display board and make sure that the is no dust on the front panel label and carefully place in the case making sure not to damage the display board screen.

7.4 5000PB00030 ISSUE 2

2.6 Refit the six securing screws removed earlier and then reconnect the flexible circuit, beam assembly strain gauge connection, potentiometer connection.

2.7 Once the control board has been fitted then the following procedures need to be followed in order for the unit to work effectively.

3.0 Full Retest on Unit

3.1 Pump Set Up and Configuration

Test	Prompt	Setting	Comments	Acc Code
RAM Clear '611'	Tick once memory cleared	[ ]		***611***
Syringe Range U,BP,J	Universal, Braun Perfusor, Janpol			***359***
Language	GB,D,F,N.....			
Clock	Set Date and Time	__/__/__ __:__		***251***
Declutch microswitch set	0 ⇒ 1		Pass/Fail	***126***
EOI Point Setting	0 ⇒ 1		Pass/Fail	
Plunger detect test	0 ⇒ 1		Pass/Fail	
Cover Detect	0 ⇒ 1			
Syringe size (Bottom)	+030 ⇒ +060			
Syringe size (Top)	+180 ⇒ +255			
Occlusion base level	Set +000			
Leadscrew Greased?	Check Leadscrew greased			

Test Results Sheet

Test	Prompt	Setting	P/F	Access Code
Software version	VXRX	V R		***123***
Syringe range U,BP,J	Universal, Braun Perfusor, Janpol.			
Battery Voltage	AC Unplugged (5.0 to 6.8V)	. V		***124***
Audible alarm	Alarm Sounding	******		
Display test	Check all dots illuminate	*******		***125***
Backlight Dim Check	Check Backlight Dim	Dim		
Backlight Off Check	Check Backlight Off	Off		
Button Test	S1 (Start) to S10 (Purge)	*******		
LEDs (Start & Stop)	Check LEDs Flashing	*******		
Declutch switch	0 ⇒ 1	*******		

7.4 5000PB00030 ISSUE 2

EOI opto	0 ⇒ 1 (Beep!)	*******		
Grid opto	0 ⇒ 1	*******		
Plunger detect test	1 ⇒ 0	*******		
Motor test Encoders	0 ⇒ 1	*******		
Cover Detect	0 ⇒ 1	*******		
Handset - Button	OFF ⇒ ON ⇒ OFF	*******		***127***
- LED	On when button pressed.	*******		
Keyswitch	RUN ⇒ SET ⇒ RUN	*******		
Nurse Call	T'Gear alarm sounds on/off	*******		
Syringe size calibration	Small Spacer (030 .. 060)			***243***
	Large Spacer (170..210)			
	Difference			
Occlusion calibration	Base level 0Kgf (-006 to +006)			***717***
	10Kgf. (<=+220)			
	4.0kgf (+050 ..+100)			
	Difference 0Kgf to 4Kgf			
Occlusion test	3.7Kgf to 4.1Kgf	kgf		

Note Any Special Codes Configured Here ⇒⇒⇒⇒⇒	

Test	Prompt	Setting	P/F	Access Code
Speed test	m : ss : ss	: :		
P.E. resistance test	<10 K	<10 KΩ		
Insulation resistance	>200M	>200MΩ		
AC power failure	AC Alarms & LED off	*******		
Communications test	RS232 or RS485	*******		
	Printer function	*******		
Set RS232 to OFF	General Opt.14, Set to NO	*******		***251***
Linear Performance Test	<0.75 ml Peak To Peak	5ml/hr		METLIN34

COMMENTS:

7.4 5000PB00030 ISSUE 2

Test	Prompt	Setting	Initials	P/F	Access Code
Battery run start	dd/mth/Year hrs/mins	__/__/__ ____:____			
Battery run 6hrs @ 2.5 ml/hr.	BD Plastipak, Braun Perfusor, or Janpol 50ml		****** ******		
Volume infused	15ml ± 0.2ml	ml	******		
Syringe check	35ml ± 1.0ml	ml	******		
Base level recheck	Cal Reading ± 4		******		***717***
Clock Check	Time Correct?	*******	*******		
Check Language	GB,D,F,N		*******		

CODES:

Enter a tick in pass/fail (P/F) box for passes. Enter an "F" in pass/fail (P/F) box for failures.

3.1.1 FINAL QUALITY CONTROL CHECK

This procedure is to be followed after completion of final tests and prior to transfer to the finished goods location. Complete each check and circle 'YES' or 'NO' as appropriate.

Test	Pass QC	
DOCUMENTATION		
Final tests completed, logged and within stated limits.	YES	NO
Pump information correct and all serial numbers recorded on test sheet.	YES	NO
LABELLING		
All labels of correct type and language (inc. Handset Label) and correctly positioned.	YES	NO
SELF TEST		
Self test undertaken and all tests passed, language configuration correct . (123 Test)	YES	NO
ELECTRICAL		
Unit resets correctly on first turn-on and off several times.	YES	NO
The previous patient data has been cleared. Switch to SET, press Yes Twice	YES	NO
Backlight on.	YES	NO
All switches operate correctly. Ensure that switches do not require excessive operating force, or are too sensitive. (125 Test)	YES	NO
The handset operates correctly (127 Test) and is easily unplugged.	YES	NO
Record error codes from service log (Code 376):		
Clear service log and press RESET.	YES	NO

7.4 5000PB00030 ISSUE 2

MECHANICAL		
Pole clamp is present and correctly secured.	YES	NO
Syringe clamp rotates and lifts freely. Syringe sizing operates correctly and the sizes are displayed as appropriate.	YES	NO
Transmission is free and has no excessive mechanical noise when moved manually or when unit is running.	YES	NO
Cover detected as opened when key turned.	YES	NO
All feet are present and secured.	YES	NO
No loose components are detected inside the pump when shaken.	YES	NO

4.0 Technical Inquires

For additional technical assistance, contact your local ALARIS Service Operations.

7.5 5000PB00031 ISSUE 1

Linear Grid P5000

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 5000PB00004 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cable Part No. 5000JG00001.

1.0 Introduction.

This instruction applies to all Linear Grids as fitted to all models of the P5000 Syringe Pumps.

2.0 Removal Instructions

2.1 Remove the 3 mounting screws.
2.2 Withdraw grid.

3.0 Fitting Instructions

3.1 To fit new grid reverse the above directions.
3.2 Be sure the grid is level when rectified.

4.0 Technical Inquires

For additional technical assistance, contact your local ALARIS Service Operations.

7.6 5000PB00021 ISSUE 5

SPARES KIT CASE LOWER P5000

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 5000PB0004 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

Always protect the plunger holder, cover and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. For regular servicing we recommend the use of the upper case support cradle Part No. 5000JG00001. This will avoid damaging the mechanism or the cover.

1.0 Introduction

This fitting instruction applies to P5000 units with build issues 46 and above.

This fitting instruction applies to the hard tooled lower case 5000ME00067. The lower case 5000ME00001 has been superseded by 5000ME00067. 5000ME00001 has been superseded as a part of the introduction of the hard tooled P5000 cases.
The RS232 gaskets 1000ME01074 and 1000ME01079 have been superseded by a new gasket 1000ME01106, which has a fold-over cap to protect against fluid ingress
To carry out the instructions listed below access to the upper case assembly is required.
This fitting instruction refers to the spares kit 5000SP00018.

7.6 5000PB00021 ISSUE 5

2.0 Access to the Pump

2.1 Place the unit on a static dissipative surface that is correctly grounded.
2.2 Remove the six case retaining screws (M4 x 45mm pan head) located on the base of the unit .
2.3 Carefully separate the upper and lower case halves and disconnect the cable assemblies between the power supply board and the control board assembly.

3.0 Fitting & Removal Instructions Lower Case

3.1 Disconnect the mains inlet, the handset inlet, and the battery connectors from their sockets on the power supply board.
3.2 Remove the four power supply board retaining screws 0000ME00187 and remove the power supply board 5000EL00060/61. See figure 1 for further information.
3.3 Remove the two battery plate retaining screws from the lower case assembly. Remove the battery retaining plate and the battery. Keep these for refitting later. See figure 1 for further information.
3.4 Remove the handset inlet ground braid retaining screw 0000ME00011. Remove the nut from the handset inlet assembly 5000SP00027 and remove the handset inlet assembly from the lower case. See figures 1 and 3 for further information.
3.5 Remove the retaining screws 0000ME00230 from the mains inlet assembly 1000SP01001 and remove the mains inlet assembly from the lower case. Retain these for refitting later. See figure 1 for further information.
3.6 Remove the three pole clamp fixing screws 0000ME00227 and remove the pole clamp from the lower case assembly. Retain these for refitting later.

7.6 5000PB00021 ISSUE 5

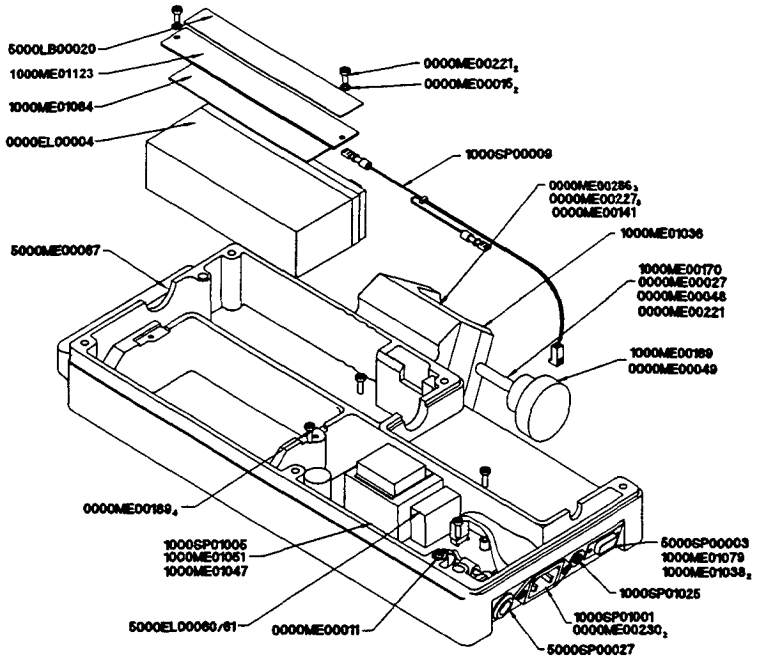


Figure 1

3.7 Turn the lower case over and remove the four base plate fixing screws 0000ME00222 and remove the base plate 1000ME01005. Retain the fixing screws for reassembly. See figure 2 for further information.

3.8 Disconnect the RS232/RS485 connector 5000SP00003 and the nursecall connector 1000SP01025 from the communications board 5000EL00022/28.

3.9 Remove the spacers 0000ME00279 and remove the RS232/485 5000SP00003 connector and the old gasket 1000ME01079 from the lower case assembly. Discard the old gasket, but retain the connector assembly for later. Remove the nut securing the nursecall connector, and keep the connector assy and the nursecall seal for refitting later. See figure 2 for further information.

3.10 Remove the three communications board fixing screws from the lower case, remove the communications board, the screws and nylon washers for reassembly. See figure 2 for further information.

3.11 Remove the silicone sealing cord from the groove in the lower case. Retain the cord for refitting later.

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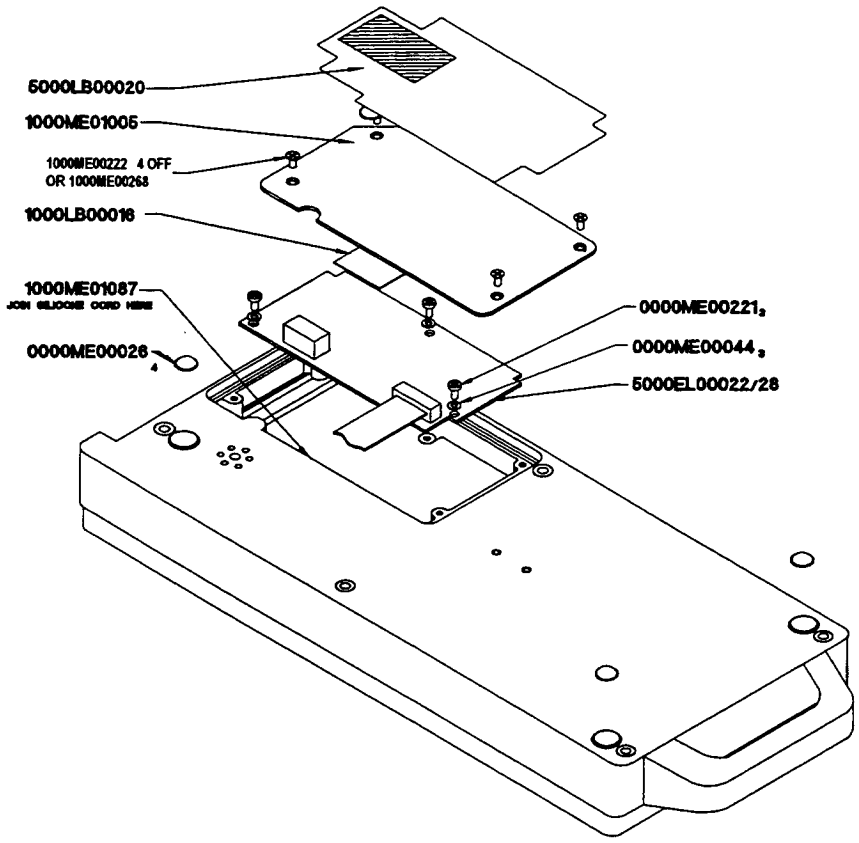
Figure 2



4.0 Fitting the new Lower Case

4.0 Fit the appropriate end label supplied 5000LB00020 to the lower case supplied. Fit the new serial number and build issue label into the lower case, ensure that the information which is displayed on the existing labels is transferred onto the new labels. The correct positioning of the labels can be seen on the existing lower case.

4.1 Fit the RS232/485 connector assembly and the new RS232 gasket 1000ME01106 to the lower case. Secure the assembly with the spacers 0000ME00279 removed earlier. See figure 4 for further information. When RS232/485 is not in use, the rubber cap on the gasket should be folded down over the connector to prevent ingress through the pins.

4.2 Fit the nursecall connector 1000SP01025 and seal to the lower case. See figure 2 for further information.

4.3 Feed the RS232 cable through the slot in the lower case and refit the communications board with the fixing screws and nylon washers removed earlier.

4.4 Refit the RS232/485 connector and the nursecall connector to the communications board.

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4.5 Fit the silicone sealing cord into the groove in the lower case. The joint has to be in the position shown in figure 2.

4.6 Fit the base plate 1000ME01005 and secure with the screws 0000ME00222 retained from earlier.

4.7 Fit the three feet 0000ME00026 supplied in the positions shown in figure 2.

4.8 Position the power supply board and alarm tube assembly into the lower case, secure using the M3x12 posi head fixing screws 0000ME00189. See figure 2 for further information.

4.9 Fit the mains inlet connector and gasket, secure the assembly with the two M3 X 8 csk fixing screws 0000ME00230.

4.10 Fit the handset inlet connector assembly 5000SP00027 fit the two sealing washers one on each side of the case wall. Secure the handset inlet connector with the nut supplied. Secure the handset ground braid to the case using the fixing screw 0000ME00011 retained from earlier. See figure 3 for further information.

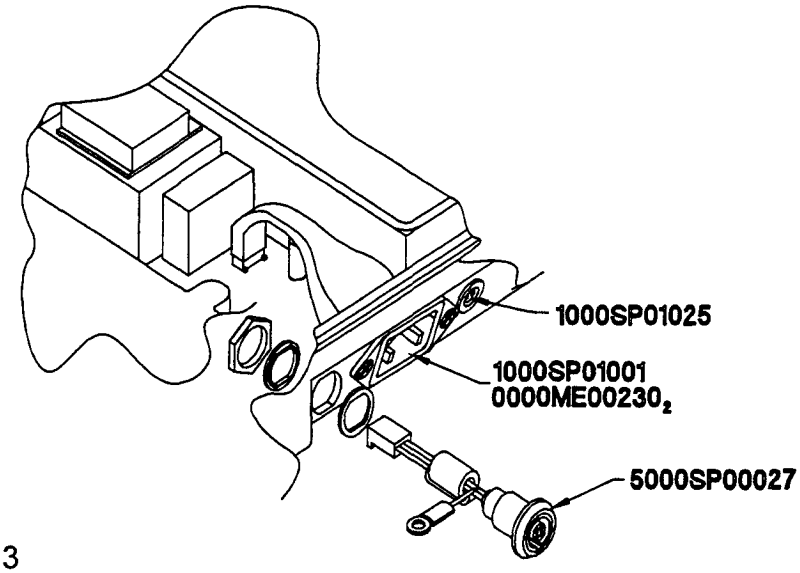

Figure 3

4.11 Fit the mains inlet connector, the handset connector and the alarm tube connector to the power supply board. See figure 2 for further information.

4.12 Fit the battery and battery plate into the lower case and secure using the 2 fixing screws and washers 0000ME00221 and 0000ME00015 retained from earlier, ensure that the cable assembly is loomed so the cable is tucked in the slot in the lower case under the battery plate. Fit the battery connector to the power supply board. See figure 2 for further information.

4.13 Fit the pole clamp retained from earlier and fix with the three retaining screws 0000ME00227 and washers 0000ME00045 kept from earlier.

7.6 5000PB00021 ISSUE 5

5.0 Upper and Lower Case Assembly

5.1 Reconnect the cable assemblies between the control board and the power supply board.
5.2 Ensure that the cable assemblies are not trapped when the upper and lower case assemblies are fitted together.
5.3 Fit the six case fixing screws and washers retained from earlier.
5.4 Connect the handset assembly and test the correct operation of the handset assembly.
5.5 Complete a self test routine as described in the technical service manual.

6.0 Technical Inquiries.

For additional technical assistance, contact your local ALARIS Service Operations.

7.7 5000PB00032 ISSUE 2

Fitting & Removal Instructions for Power PCB Assembly P5000

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 5000PB00004 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 5000JG00001.

1.0 Introduction.

This instruction applies to all Power PCBs as fitted to all models of the P5000 Syringe Pumps.

2.0 Fitting & Removal Instructions

2.1 Disconnect AC leads, DC power ON/OFF and battery connections from board.

2.2 Remove the four mounting screws (0000ME00189). Retain the screws for board reassembly.

2.3 Withdraw the power PCB assembly from unit.

2.4 To fit a new power PCB assembly, place the new board in position and reconnect the AC leads, DC power ON/OFF and the battery connections

2.5 If a new assembly is fitted then the following procedures need to be followed in order for the unit to work effectively.

7.7 5000PB00032 ISSUE 2

3.0 Self Test '123'

3.1 Turn the keyswitch from **OFF** to **SET** position while holding down the **START** button.
3.2 Enter **"123"** using the **"+"** and **"-"** and **NEXT** buttons.
3.3 Press **ENTER** to commence self test sequence.
3.4 The unit will now proceed through a series of tests as described below.

Press the **NEXT** button to move to the next test, or press the **QUIT** button to exit the self test mode and return to normal operation.

3.5 Should the unit fail this test sequence, it should be taken out of use and inspected by a qualified service engineer.

DISPLAY		TEST DESCRIPTION
1	**SOFTWARE REVIEW**	**SOFTWARE/SET UP REVIEW:** Include software version, program crc, language, communications fitted.
2	**SYRINGE REVIEW**	**REVIEW SET UP OF SYRINGE CALIBRATION DATA:** Including syringe calibration, occlusion calibration and syringe range.
3	_._ _ **V**	**INTERNAL PSU VOLTAGE:**
4	**"BEEP"**	**AUDIBLE ALARM TEST:** Check alarm sound continuously.
5		**DISPLAY AND BACKLIGHT DIM TEST:** Check that all the display is operating and that the display operates on full backlight for the first part of the test, dims for the second part and then switches off at the end of the test.
6	**PRESS S1**	**TOUCH PANEL SWITCH TEST:** Press buttons in turn from S1 to S10 from **START** to **PURGE** until reach end of test.
7	**FLASHING "LEDS"**	**INDICATOR LED TEST:** Check that the **STOP** and **START** LED's are flashing.
8	**DECLUTCH**	**DECLUTCH SWITCH TEST:** Squeeze the plunger holder finger grips and check that the display alternates between 1 (engaged) and 0 (disengaged - finger grips squeezed together).

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9	**EOI opto: 0**	**NEAR END OF INFUSION TEST:** Starting with an empty, extended 50/60ml syringe on the unit, squeeze the finger grips and move the plunger holder slowly to the left. Check that the display switches from 0 to 1. The position at which the display changes will depend on the syringe type being used. (For example 6ml on a BD Plastipak 50/60ml syringe and 3ml on a Terumo 50ml syringe)
10	**Grid opto: 0**	**LINEAR GRID TEST**: Squeeze the finger levers and position the drive mechanism to the right, then slowly move the syringe plunger holder to the left observing the display alternate between **0** (OPTO over slot) and **1** (OPTO over bar).
11	**Plunger opto: 0**	**PLUNGER DETECTOR TEST:** Press plunger plate button. Check display switches from **1** (No syringe fitted) to **0** (Syringe plunger fitted).
12	**Motor/encoder: 1**	**MOTOR ENCODER TEST**: Motor is pulsed while encoders are tested. Check display changes from **0** to **1** as encoders pass.
13	**Cover detect: 0**	**COVER DETECT TEST:** Open and close the cover. Check that display changes from **0** (cover open) to **1** (cover closed).
14	**Syringe Pot: _ _ _**	**SYRINGE SIZE DETECTION SYSTEM:** Lift syringe clamp and check that the number shown in the display increases within the normal range (approx. **045 to 215**).
15	**Beam Value: _ _ _**	**PUMPING PRESSURE DETECTION TEST**: Remove syringe and confirm that value is within normal range **(-020 to +020)**. Gently press back on the plunger holder and observe the value increase.
16	**Handset: OFF**	**PATIENT HAND SET TEST:** Connect patient hand set. Check display switches from **OFF** to **ON** as the button is pressed.
17	**Keyswitch: SET**	**KEY SWITCH TEST:** Turn key from **SET** position to **RUN** position. Check display changes.

7.7 5000PB00032 ISSUE 2

18	Nursecall on/off/on	
19	CONFIGURATION SUMMARY	Summary of user defined options selected.
20	NEXT	Returns unit to normal operation.

3.1 Battery Run

3.1.1 Ensure that the pump is fully charged.
3.1.2 Disconnect the pump from the A.C supply.
3.1.3 Fit a B-D Plastipak, Braun Perfusor or Janpol test syringe as appropriate to the pump and set the leading edge of the plunger to 50ml.
3.1.4 Set the pump to run at a rate of 2.5ml/hr.
3.1.5 Turn the pump on.
3.1.6 Start the pump and run for 6 hours or until the Low Battery Warning. If the low battery occurs before 6 hours has elapsed the pump will have failed the test. Recharge the battery for 24 hours and retest.

3.2 Electrical Safety Test

The equipment required for the electrical safety test is as follows:

500V DC megger tester.
Modified AC power cable with plug fitted and live and neutral pins linked.

3.2.1 Ensure the pump that is under test is switched OFF and not connected to the AC power.
3.2.2 Connect one lead from the megger to the modified AC power cable and the other to the exposed metal leadscrew of the pump under test.
3.2.3 Activate the megger and keep the button depressed whilst the needle settles.
3.2.4 For the pump to pass this section the value displayed must be greater than 200M.
3.2.5 If the reading is less than this, the pump fails this test and must be removed from service and investigated further.

3.3 Potential Equalisation Terminal Resistance Test

The equipment required for the potential equalisation terminal resistance test is as follows:

DVM Resistance Meter (e.g Fluke)

7.7 5000PB00032 ISSUE 2

3.3.1 Connect one lead from the DVM resistance meter to the PE terminal on the pole clamp of the unit and the other to the pump leadscrew. Check that the settled value of resistance is less than 10K.

3.3.2 Move the lead from the leadscrew and repeat the check with the lead to the outer tube. Check that the settled value of resistance is less than 10K.

3.3.3 If both the value are less than 10K then place the pump back into operation.

3.3.4 If the value of either of the readings are greater than 10K, the pump fails this test and must be removed from service and investigated further.

3.4 AC Power Fail Test

3.4.1 Connect the pump to a convenient AC power source and ensure that the AC power LED is illuminated.

3.4.2 Turn the keyswitch to **SET**.

3.4.3 Unplug the AC power cord. The pump should alarm intermittently and indicate 'AC Power Failure'. Ensure that the battery LED is illuminated and that the AC power LED is not.

4.0 Technical Inquires

For additional technical assistance, contact your local ALARIS Service Operations.

7.8 5000PB00033 ISSUE 1

Battery P5000

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 5000PB00004 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cable Part No. 5000JG00001.

1.0 Introduction.

This instruction applies to all Batteries as fitted to all models of P5000 Syringe Pumps.

2.0 Removal Instructions

2.1 Carefully disconnect battery socket from Power PCB assembly.
2.2 Remove two mounting screws from battery retaining plate
2.3 Retain screws and washers for reassembly.
2.4 Withdraw battery and retaining plate from unit.
2.5 Disconnect crimp terminals from battery.
2.6 Detach retaining plate from battery, breaking bond created by adhesive pads.

3.0 Fitting Instructions

3.1 To fit new assembly reverse the above directions.

7.8 5000PB00033 ISSUE 1

4.0 Technical Inquires

For additional technical assistance, contact your local ALARIS Service Operations.

7.9 5000PB00034 ISSUE 1

Mains Fuse P5000

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 5000PB00004 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cable Part No. 5000JG00001.

1.0 Introduction.

This instruction applies to all Main Fuses as fitted to all models of the P5000. If the pump continually displays the battery symbol and the AC power indicator light does not illuminate when the pump is connected to the AC power supply and switched **ON**, suspect that either the power supply fuse or the internal fuse has blown.

2.0 Removal Instructions

2.1 Turn the keyswitch to the **OFF** position and disconnect the unit from the AC power supply.

2.2 Carefully support the unit upside down and remove the six fixing screws. The pole clamp and base plate may be left in position.

7.9 5000PB00034 ISSUE 1 (CONT)

2.3 Carefully separate the upper and lower sections of the unit and identify fuse holder reference FS1 on the power supply PCB in the lower case assembly.

2.4 Unscrew the fuse holder cap, remove and check the fuse.

2.5 If the fuse has blown, fit a new fuse of the correct type and rating. Do not exceed the current rating specified.

Fuse: 220/240V units - T63mA Time Lag (5mmx20mm) (Pt/No. 0000EL00287)
110/120V units - T125mA Time Lag (5mmx20mm) (Pt/No. 0000EL00288)

2.6 If the fuse fails again after a short period, or the fuse in the power supply plug fails, take the unit out of service for examination by a qualified service engineer.

3.0 Technical Inquires

For additional technical assistance, contact your local IVAC Service Operations.

7.10 5000PB00040 ISSUE 2

Fitting Instructions Cover P5000

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 5000PB00004 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 5000JG00001.

1.0 Introduction

The PCAM cover 5000ME00064 has been superseded by 5000ME00099. The magnet holder 5000ME00091 has been superseded by 5000ME00094. The Spring Mechanism 5000ME00071 has been superseded by 5000ME00095. The Sleeve 5000ME00034 has been superseded by 5000ME00096. The assembly has been designed to improve reliability and ease of assembly. The bush 5000ME00073 has been superseded by 5000ME00097, the bush is no longer required for the cover assembly.
Access to the upper case is not required to complete this upgrade.
A No. 8 snake eyed screwdriver (0000ME000202) will be required to complete this upgrade.
This spares replacement applies to PCAM pump with the build issue 66 and below, the upgrade kit part number is 5000SP00040.

7.10 5000PB00040 ISSUE 2

2.0 Fitting Instructions

2.1 Remove the snake eyed screws 0000ME00157 holding the cover assembly to the upper case, discard the old cover assembly.

2.2 Assemble the magnet holder 5000ME00094, dowel pin 0000ME00156 and magnet 0000ME00278 and insert into the cover. Ensure that the clip labelled 'A' (see figure 1) is inserted first, then the clip labelled 'B'. Secure the assembly using an M3x6 c/sunk screw 0000ME00222.

2.3 Assemble the spring mechanism 5000ME00095, spring arm 5000ME00052 and spring 0000ME00183. Ensure that the clip labelled 'A' (see figure 1) is inserted first, then the clip labelled 'B'. Secure the assembly using an M3x6 c/sunk screw 0000ME00222.

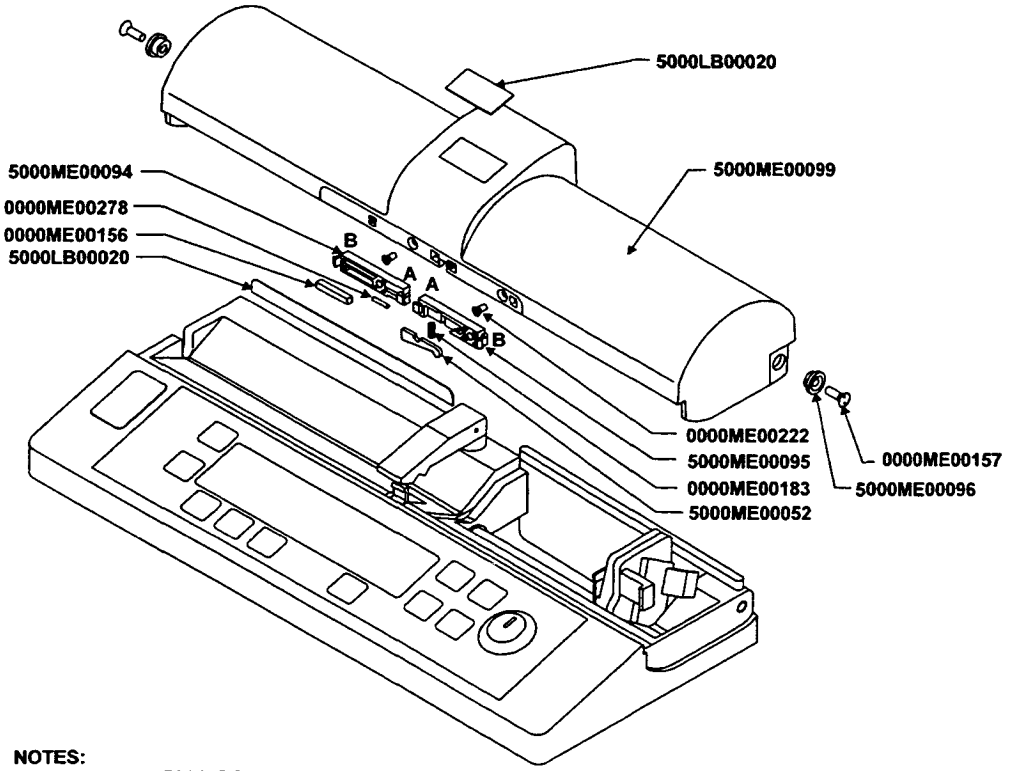
2.4 Locate the blanking label 5000LB00020 into the recess in the cover.

2.5 Fit the sleeves 5000ME00096 to the cover. Before fitting the snake eyed screws apply a small amount of loctite 242 to the thread.

NOTE:ENSURE THAT THE LOCTITE 242 DOES NOT COME INTO CONTACT WITH THE COVER OR THE UPPER CASE AS THIS WILL IMPAIR THE OPERATION OF THE ASSEMBLY.

2.6 Test the cover assembly opens correctly, and return the pump to service.

Figure 1



NOTES:
1. APPLY 0000ME00157 TO 5000ME00096 BEFORE ASSEMBLY.
2. WHEN FITTING MAGNET HOLDER 5000ME00094 AND SPRING MECHANISM 5000ME00095, ENSURE ENDS LABELLED 'A' ARE INSERTED FIRST, THEN THE ENDS LABELLED 'B'. THESE ASSEMBLIES ARE SECURED WITH 2 SCREWS 0000ME00222.

7.10 5000PB00040 ISSUE 2

4.0 Technical Inquiries.

For additional technical assistance, contact your local ALARIS Service Operations.

7.11 5000PB00036 ISSUE 1

Cover Lock P5000

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 5000PB00004 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cable Part No. 5000JG00001.

1.0 Introduction.

This instruction applies to all Pcam cover locks as fitted to all models of the P5000.

2.0 Removal Instructions

2.1 Remove the Control and Display Board as per instructions in 5000PB00030.

2.2 Remove the extension springs from the lock cam and the rod, then remove the spring plate, 5000ME00053 from the upper by unscrewing the fixing screw, M3x6 pan heads and then the washer.

2.3 Remove the lock nut from the back of the mechanical lock, then remove the cam, then the washer.

2.4 Ensure that the key is in the lock when this is being done, otherwise the lock will fall apart when the barrel is removed from the lock body.

2.5 Remove the nut from the back of the lock, which holds the lock to the case. Then remove the lock body from the case upper. Including the sealing washer on the case 5000ME00046.

2.6 Unscrew the M3x6 pan head screw from the rod support 5000ME00030.

2.7 Remove the circlip from the inside of the upper on the rod.

2.8 Remove the M3x5 socket set cup point from the latch cam 5000ME00031.

2.9 Remove the latch cam and the O ring from the rod at the same time as removing the rod from the case from the inside. The washer and rod support will still be on the rod.

3.0 Fitting Instructions

3.1 To replace the lock mechanism do step 2.1 to 2.9 in reverse, checking that the lock operates correctly and remember to use Loctite 242 on the M3x5 socket set cup point when fixing the latch cam to the rod..

4.0 Technical Inquires

For additional technical assistance, contact your local ALARIS Service Operations.

7.12 5000PB00037 ISSUE 1

Handset Connector P5000

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 5000PB00004 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cable Part No. 5000JG00001.

1.0 Introduction.

This instruction applies to all Handset connectors as fitted to all models of the P5000.

2.0 Removal Instructions

2.1 To change the handset connector access to the lower case is necessary.

2.2 Disconnect the handset connector from the power board, by removing the ribbon cable from the board.

2.3 Unscrew the nut on the inside of the lower case and remove this from the ribbon cable.

2.4 Remove the connector body and washer from the case.

7.12 5000PB00037 ISSUE 1 (CONT)

3.0 Fitting Instructions

3.1 To reassemble do section 2.1 to 2.4 in reverse.

4.0 Technical Inquires

For additional technical assistance, contact your local ALARIS Service Operations.

7.13 5000PB00042 ISSUE 1

Fitting & Removal Instructions for Transmission Assembly P5000

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 5000PB00004 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 5000JG00001.

1.0 Introduction.

This instruction applies to the Transmission Assembly fitted to the P5000 Syringe Pump.

2.0 Fitting & Removal Instructions.

2.1 Remove the six transmission assembly screws (0000ME00255 x 2off, 0000ME00246 x 3 off and 0000ME00225), the four wavey washers (0000ME00045), the flexible circuit assy and the beam connection from the transmission assembly.
2.2 Retain screws and washers for reassembly.
2.3 Withdraw the transmission from the upper case.
2.4 To fit a new transmission assembly, place the transmission into the upper case, ensuring that the seals are correctly located and that the beam is positioned before securing into position.
2.5 Secure the transmission in place using the screws earlier removed.

7.13 5000PB00042 ISSUE 1 (CONT)

2.6 Once the transmission assembly has been fitted then the following procedures need to be followed in order for the unit to work effectively.

3.0 Self Test '123'

3.1 Turn the keyswitch from **OFF** to **SET** position while holding down the **START** button.
3.2 Enter **"123"** using the **"+"** and **"-"** and **NEXT** buttons.
3.3 Press **ENTER** to commence self test sequence.
3.4 The unit will now proceed through a series of tests as described below.

Press the **NEXT** button to move to the next test, or press the **QUIT** button to exit the self test mode and return to normal operation.

3.5 Should the unit fail this test sequence, it should be taken out of use and inspected by a qualified service engineer.

	DISPLAY	TEST DESCRIPTION
1	**SOFTWARE REVIEW**	**SOFTWARE/SET UP REVIEW:** Include software version, program crc, language, communications fitted.
2	**SYRINGE REVIEW**	**REVIEW SET UP OF SYRINGE CALIBRATION DATA:** Including syringe calibration, occlusion calibration and syringe range.
3	**_._ _ V**	**INTERNAL PSU VOLTAGE:**
4	**"BEEP"**	**AUDIBLE ALARM TEST:** Check alarm sound continuously.
5		**DISPLAY AND BACKLIGHT DIM TEST:** Check that all the display is operating and that the display operates on full backlight for the first part of the test, dims for the second part and then switches off at the end of the test.
6	**PRESS S1**	**TOUCH PANEL SWITCH TEST:** Press buttons in turn from S1 to S10 from **START** to **PURGE** until reach end of test.
7	**FLASHING "LEDS"**	**INDICATOR LED TEST:** Check that the **STOP** and **START** LED's are flashing.
8	**DECLUTCH**	**DECLUTCH SWITCH TEST:** Squeeze the plunger holder finger grips and check that the display alternates between 1 (engaged) and 0 (disengaged - finger grips squeezed together).

7.13 5000PB00042 ISSUE 1 (CONT)

9	**EOI opto: 0**	**NEAR END OF INFUSION TEST:** Starting with an empty, extended 50/60ml syringe on the unit, squeeze the finger grips and move the plunger holder slowly to the left. Check that the display switches from 0 to 1. The position at which the display changes will depend on the syringe type being used. (For example 6ml on a BD Plastipak 50/60ml syringe and 3ml on a Terumo 50ml syringe)
10	**Grid opto: 0**	**LINEAR GRID TEST**: Squeeze the finger levers and position the drive mechanism to the right, then slowly move the syringe plunger holder to the left observing the display alternate between **0** (OPTO over slot) and **1** (OPTO over bar).
11	**Plunger opto: 0**	**PLUNGER DETECTOR TEST:** Press plunger plate button. Check display switches from **1** (No syringe fitted) to **0** (Syringe plunger fitted).
12	**Motor/encoder: 1**	**MOTOR ENCODER TEST**: Motor is pulsed while encoders are tested. Check display changes from **0** to **1** as encoders pass.
13	**Cover detect: 0**	**COVER DETECT TEST:** Open and close the cover. Check that display changes from **0** (cover open) to **1** (cover closed).
14	**Syringe Pot: _ _ _**	**SYRINGE SIZE DETECTION SYSTEM:** Lift syringe clamp and check that the number shown in the display increases within the normal range (approx. **045 to 215**).
15	**Beam Value: _ _ _**	**PUMPING PRESSURE DETECTION TEST**: Remove syringe and confirm that value is within normal range **(-020 to +020)**. Gently press back on the plunger holder and observe the value increase.
16	**Handset: OFF**	**PATIENT HAND SET TEST:** Connect patient hand set. Check display switches from **OFF** to **ON** as the button is pressed.
17	**Keyswitch: SET**	**KEY SWITCH TEST:** Turn key from **SET** position to **RUN** position. Check display changes.

18	**Nursecall on/off/on**	
19	**CONFIGURATION SUMMARY**	Summary of user defined options selected.
20	**NEXT**	Returns unit to normal operation.

3.3 Occlusion Calibration

To set up the occlusion alarm level for pumps, use occlusion test gear 0000TG00020, 0000TG00032 and 0000JG00014 :

3.3.1 Ensure that the keyswitch is in the **OFF** position and that there is no syringe fitted to the pump.
3.3.2 Hold down the **START** button and turn the keyswitch to the **SET** position.
3.3.3 The display will read **'ACCESS CODE 0 0 0'.** Enter **717** using the ⇑+, ⇓- and ⇑ NEXT buttons.
3.3.4 The display will show **'Base level 0Kgf (typ. -006..+006) :** xx' where xx is the current reading from the pressure monitoring system in hexadecimal format.
3.3.5 Press ⇑**OK** to start the drive and allow it to run for approximately 30 seconds to enable the zero pressure level to settle.
3.3.6 Check that the pressure reading is in the specified range. If it is not open up the case and adjust VR1 on the control PCB until it falls in the desired range, (-006 to +006 decimal). Typically the base level is set to 000.
3.3.7 Press ⇑**CALIBRATE** to store the zero pressure level.
3.3.8 Fit the occlusion test gear 0000TG00020 to the pump and 000TG00032 (magnet) to the cover clip position, move the plunger holder towards the dial gauge until it is just clear of the pad.
3.3.9 Press ⇑**NEXT**. The pump will display **'Test gear 4.0Kgf (+050..+100) :** xx'. Allow the pump to run until the dial gauge on the test gear reads 4Kgf.
3.3.10 Press ⇑**CALIBRATE** to store the 4kgf level. The display will read **'Difference 0kgf to 4.0kgf :** xx'. Where xx is the difference in decimal format.
3.3.11 Press ⇑**QUIT** to return to normal operation of the pump.

If Software revision greater than V2R5 follow this section after point 9.

1. Turn key to off position and then turn to run position for normal operation.

3.3.2 Occlusion Test and Limits for the ALARIS PCAM

To test the **PCAM** occlusion alarm levels use test gear 0000TG00020 and 0000TG00032 and follow the procedure below:

1 Declutch plunger holder and move to the right.

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2. Fit occlusion test gear 0000TG00020 to the pump and 0000TG00032 (magnet) to the cover clip position, move the plunger holder towards the test gear actuator pad, leaving the plunger holder just clear of the actuator pad.

3. Set the pump to run at a continuous rate of 20ml/hr and press **START**.

4. When the pump indicates line occlusion and alarms press **STOP.**

5. Read the occlusion level from the test gear dial and check that the unit alarms at the desired level. See Table 3.3.3.

6. If outside the stated limits then repeat the occlusion calibration procedure and re-test otherwise declutch, remove the test gear and switch **OFF.**

The values shown in Table 3.3.3 are for 50/60ml syringes only.

The alarm level for each syringe type is equivalent to 375mmHg line pressure, with the limits being +/- 50mmHg of this point.

Table 3.3.3
50/60ml Syringe Occlusion Test Limits for the PCAM with occlusion alarm level set to L4

Syringe Type	Alarm Level (Kgf)	Lower Limit (Kgf)	Upper Limit (Kgf)
BD Plastipak	3.5	3.1	3.9
IVAC	3.9	3.5	4.4
Terumo	6.5	6.0	7.0
Braun Omnifix	4.1	3.7	4.5
Braun Perfusor	4.0	3.6	4.4
Sherwood Monoject	3.9	3.5	4.4
R.R Pronto	5.7	5.2	6.2
Rapiject	3.3	2.8	3.7
BD Worldwide	3.6	3.2	4.1
Once	3.9	3.5	4.4
Fresenius Inject	5.7	5.3	6.1

IMPORTANT

N.B: ALARM LEVEL FOR V2R6 SOFTWARE WITH BD 50 SYRINGE IS 3.5 FOR ALL PRECEDING SOFTWARE, ALARM LEVEL IS 3.9kgF. THIS SYRINGE ONLY.

DUE TO VARIATIONS IN SYRINGE MANUFACTURE, SOME DEVIATIONS FROM THE ABOVE FIGURES MAY BE EXPERIENCED WHEN TESTING THE OCCLUSION ALARM BY MEANS OF A LINE PRESSURE MEASURING DEVICE. CERTAIN SYRINGES WILL ATTAIN A 10KGF DRIVE FORCE BEFORE A HIGH OCCLUSION LEVEL IS REACHED.

3.4 Linear Speed Test

To test the linear drive accuracy use test gear 0000TG00002 and 0000TG00032 (magnet) or equivalent and follow the procedure below.

3.4.1 Declutch the drive mechanism and move the plunger holder to the right.

3.4.2 Fit the linear test gear 0000TG00002 to the pump and 0000TG000032 to the cover clip position and move the plunger holder towards to dial gauge until it is about 3mm clear of the probe.

3.4.3 Turn the keywasher to **SET** and configure the pump to run at a continuous rate of 20ml/hr. Press **START**.

3.4.4 Allow the unit to run until it touches the probe and then using a stop watch, time the travel over a distance of 10.00mm.

3.4.5 Using the values specified, check that the unit is travelling at the correct speed.

3.4.6 If the test values fall outside the stated limits then reject the unit for further investigation.

3.4.7 Switch the unit **OFF** and remove the test gear.

Note that the data for a combination of rates and syringe sizes have been provided should further testing be deemed necessary. It is not normally necessary to test for all the combinations provided.

Syringe Type	Size (ml)	Flow Rate (ml/hr)	Expected Time (min:sec)	Tolerance (1%) (+/- sec)
BD Plastipak	20	20.0	08m 30s	06s
	30	20.0	10m 46s	07s
	50	20.0	16m 21s	10s
Terumo	20	20.0	09m 26s	06s
	30	20.0	12m 28s	08s
	50	20.0	19m 29s	12s
Braun Omnifix	20	20.0	09m 19s	06s
	30	20.0	11m 28s	07s
	50	20.0	17m 50s	11s
B. Braun Perfusor	50	20.0	18m 12s	11s
Fresenius Inject.	50	20.0	19m 29s	13s
Sherwood Monoject	20	20.0	09m 25s	06s
	30	20.0	12m 56s	08s
	50	20.0	16m 21s	10s
Rapiject	50	20.0	17m34s	11s
RR Pronto	20	20.0	10m 35s	07s
	35	20.0	13m 10s	08s
	50	20.0	16m 21s	10s
ONCE	50	20.0	17m 48s	11s
IVAC	50	20.0	16m 21s	10s
	100	20.0	33m 08s	21s
BD World Wide	20	20.0	08m 30s	06s
	30	20.0	10m 46s	07s
	50	20.0	16m 21s	10s
Janpol	50	20.0	17m 51s	11s

3.5 Electrical Safety Test

The equipment required for the electrical safety test is as follows:

500V DC megger tester.

Modified AC power cable with plug fitted and live and neutral pins linked.

3.5.1 Ensure the pump that is under test is switched **OFF** and not connected to the AC power.

3.5.2 Connect one lead from the megger to the modified AC power cable and the other to the exposed metal leadscrew of the pump under test.

3.5.3 Activate the megger and keep the button depressed whilst the needle settles.

3.5.4 For the pump to pass this section the value displayed must be greater than 200M.

3.5.5 If the reading is less than this, the pump fails this test and must be removed from service and investigated further.

3.6 Potential Equalisation Terminal Resistance Test

The equipment required for the potential equalisation terminal resistance test is as follows:

DVM Resistance Meter (e.g Fluke)

3.6.1 Connect one lead from the DVM resistance meter to the PE terminal on the pole clamp of the unit and the other to the pump leadscrew. Check that the settled value of resistance is less than 10K.

3.6.2 Move the lead from the leadscrew and repeat the check with the lead to the outer tube. Check that the settled value of resistance is less than 10K.

3.6.3 If both the value are less than 10K then place the pump back into operation.

3.6.4 If the value of either of the readings are greater than 10K, the pump fails this test and must be removed from service and investigated further.

3.7 AC Power Fail Test

3.7.1 Connect the pump to a convenient AC power source and ensure that the AC power LED is illuminated.

3.7.2 Turn the keyswitch to SET.

3.7.3 Unplug the AC power cord. The pump should alarm intermittently and indicate 'AC Power Failure'. Ensure that the battery LED is illuminated and that the AC power LED is not.

4.0 Technical Inquires

For additional technical assistance, contact your local ALARIS Service Operations.

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Fitting & Removal Instructions for Display Board Assembly P5000

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 5000PB00004 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 5000JG00001.

1.0 Introduction.

This instruction applies to all Display boards fitted to the models P5000 Syringe Pump.

2.0 Fitting & Removal Instructions.

2.1 Carefully disconnect flexible circuit (1000SP01040), beam assembly strain gauge connection (1000SP00003), potentiometer connection (0000EL00267) and Ground Tag (only on 5000EL00065) from board.
2.2 Remove the six mounting screws (0000ME00189). Retain screws and washers for board reassembly.
2.3 Withdraw control and display PCB Assemblies from unit.
2.4 Carefully disconnect control and display boards.
2.5 To fit a new display board assembly, connect the board to the control board and make sure that the is no dust on the front panel label and carefully remove the plastic cover protecting the display screen, place in the case making sure not to damage the display board screen.

2.6 Refit the six securing screws removed earlier and then reconnect the flexible circuit, beam assembly strain gauge connection, potentiometer connection.

2.7 Once the display board has been fitted then the following procedures need to be followed in order for the unit to work effectively.

3.0 Self Test '123'

3.1 Turn the keyswitch from **OFF** to **SET** position while holding down the **START** button.

3.2 Enter **"123"** using the **"+"** and **"-"** and **NEXT** buttons.

3.3 Press **ENTER** to commence self test sequence.

3.4 The unit will now proceed through a series of tests as described below.

Press the **NEXT** button to move to the next test, or press the **QUIT** button to exit the self test mode and return to normal operation.

3.5 Should the unit fail this test sequence, it should be taken out of use and inspected by a qualified service engineer.

	DISPLAY	TEST DESCRIPTION
1	**SOFTWARE REVIEW**	**SOFTWARE/SET UP REVIEW:** Include software version, program crc, language, communications fitted.
2	**SYRINGE REVIEW**	**REVIEW SET UP OF SYRINGE CALIBRATION DATA:** Including syringe calibration, occlusion calibration and syringe range.
3	**_._ _ V**	**INTERNAL PSU VOLTAGE:**
4	**"BEEP"**	**AUDIBLE ALARM TEST:** Check alarm sound continuously.
5		**DISPLAY AND BACKLIGHT DIM TEST:** Check that all the display is operating and that the display operates on full backlight for the first part of the test, dims for the second part and then switches off at the end of the test.
6	**PRESS S1**	**TOUCH PANEL SWITCH TEST:** Press buttons in turn from S1 to S10 from **START** to **PURGE** until reach end of test.
7	**FLASHING "LEDS"**	**INDICATOR LED TEST:** Check that the **STOP** and **START** LED's are flashing.

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8	**DECLUTCH**	**DECLUTCH SWITCH TEST:** Squeeze the plunger holder finger grips and check that the display alternates between 1 (engaged) and 0 (disengaged - finger grips squeezed together).
9	**EOI opto: 0**	**NEAR END OF INFUSION TEST:** Starting with an empty, extended 50/60ml syringe on the unit, squeeze the finger grips and move the plunger holder slowly to the left. Check that the display switches from 0 to 1. The position at which the display changes will depend on the syringe type being used. (For example 6ml on a BD Plastipak 50/60ml syringe and 3ml on a Terumo 50ml syringe)
10	**Grid opto: 0**	**LINEAR GRID TEST**: Squeeze the finger levers and position the drive mechanism to the right, then slowly move the syringe plunger holder to the left observing the display alternate between **0** (OPTO over slot) and **1** (OPTO over bar).
11	**Plunger opto: 0**	**PLUNGER DETECTOR TEST:** Press plunger plate button. Check display switches from **1** (No syringe fitted) to **0** (Syringe plunger fitted).
12	**Motor/encoder: 1**	**MOTOR ENCODER TEST**: Motor is pulsed while encoders are tested. Check display changes from **0** to **1** as encoders pass.
13	**Cover detect: 0**	**COVER DETECT TEST:** Open and close the cover. Check that display changes from **0** (cover open) to **1** (cover closed).
14	**Syringe Pot: _ _ _**	**SYRINGE SIZE DETECTION SYSTEM:** Lift syringe clamp and check that the number shown in the display increases within the normal range (approx. **045 to 215**).
15	**Beam Value: _ _ _**	**PUMPING PRESSURE DETECTION TEST**: Remove syringe and confirm that value is within normal range **(-020 to +020)**. Gently press back on the plunger holder and observe the value increase.

16	**Handset: OFF**	**PATIENT HAND SET TEST:** Connect patient hand set. Check display switches from **OFF** to **ON** as the button is pressed.
17	**Keyswitch: SET**	**KEY SWITCH TEST:** Turn key from **SET** position to **RUN** position. Check display changes.
18	**Nursecall on/off/on**	
19	**CONFIGURATION SUMMARY**	Summary of user defined options selected.
20	**NEXT**	Returns unit to normal operation.

3.3 Electrical Safety Test

The equipment required for the electrical safety test is as follows:

500V DC megger tester.
Modified AC power cable with plug fitted and live and neutral pins linked.

3.3.1 Ensure the pump that is under test is switched **OFF** and not connected to the AC power.
3.3.2 Connect one lead from the megger to the modified AC power cable and the other to the exposed metal leadscrew of the pump under test.
3.3.3 Activate the megger and keep the button depressed whilst the needle settles.
3.3.4 For the pump to pass this section the value displayed must be greater than 200M.
3.3.5 If the reading is less than this, the pump fails this test and must be removed from service and investigated further.

3.4 Potential Equalisation Terminal Resistance Test

The equipment required for the potential equalisation terminal resistance test is as follows:

DVM Resistance Meter (e.g Fluke)

3.4.1 Connect one lead from the DVM resistance meter to the PE terminal on the pole clamp of the unit and the other to the pump leadscrew. Check that the settled value of resistance is less than 10K.

3.4.2 Move the lead from the leadscrew and repeat the check with the lead to the outer tube. Check that the settled value of resistance is less than 10K.

3.4.3 If both the values are less than 10K then place the pump back into operation.

3.4.4 If the value of either of the readings are greater than 10K, the pump fails this test and must be removed from service and investigated further.

3.5 AC Power Fail Test

3.5.1 Connect the pump to a convenient AC power source and ensure that the AC power LED is illuminated.

3.5.2 Turn the keyswitch to **SET**.

3.5.3 Unplug the AC power cord. The pump should alarm intermittently and indicate 'AC Power Failure'. Ensure that the battery LED is illuminated and that the AC power LED is not.

4.0 Technical Inquires

For additional technical assistance, contact your local ALARIS Service Operations.

8.10 Pump Runs Normally And Resets After A Time.

The syringe pump reset during normal running would be characterised by a momentary bleep followed by the display showing the initial start-up screen. There are a couple of possible causes for this type of fault :

a) A reset could be caused by excessive motor noise present if the control board components C31, C32 or the 100nF surface mount capacitor fitted to the flexible circuit next to the motor connections were missing.

b) Excessive radio frequency interference can cause the pump to lock up or reset. One possible source of interference in an operating theatre is diathermy equipment. The source of the interference should be identified if possible and the pump located as far from the source as possible to minimise the effect of radiated interference. Conducted interference on mains cables can be reduced both by fitting an appropriate in line filter in the pump mains connection to reduce its susceptibility and in the mains cable to the source of the interference to reduce emission from the source.

Should you encounter a reset further information can be obtained from your local ALARIS service centre.

8.8 Pump Delivery Rates Suspected Excessive/Variable/Low.

Specialised equipment is required to check delivery rate accuracy. However serious damage to the transmission could yield slightly excess, variable, or low rates. Check for damage to the pump characteristic of it having been dropped.

Visually check the straightness of the transmission lead screw. It may be worth dismantling the transmission and removing the leadscrew to check its straightness.

Check also for interference which may prevent the leadscrew rotating smoothly.

Check for foreign materials, incorrect routing of the battery wires or the flexible circuit not secured.

In the event that an error has not been observed during evaluation to this stage, the pump should be returned to the **IVAC** service centre for further analysis.

8.9 Power-up Continuous Alarm, Abnormal Display.

The syringe pump is designed to alarm if any significant component of the pump fails. If a continuous alarm sounds when the pump is powered up check :

1. That the connector from the control board to power board is fitted correctly.
2. That the 5V regulator on the control board is functioning correctly with 4.9 to 5.1V on its output.
3. That there are no short circuits on the control or power supply boards.
4. That IC5 (Microcontroller) is fitted correctly.

If there is a short circuit on the power board the voltage will be limited to the control board by the zener diodes D10 and D11.

to solve this problem is '611' memory reset and full calibration. If this code occurs only once, then it is an abnormal transient test failure.

8.7.20 Malfunction Code 34 - Soft Fault

This error occurs when the software has internally tried to divide 0 - an illegal operation and it has not been successful.

8.7.21 Malfunction Code 35 - Microcontroller

The microcontroller has been asked to perform an unknown operation.

8.7.22 Malfunction Code 36 - Address Error

The error has made several attempts to access a word on the odd address boundary.

8.7.23 Malfunction Code 37 - Soft Fault

A non-maskable interrupt (NMI) has been requested, unfortunately this pin is not used on the PCAM and is wired inactively.

8.7.24 Malfunction Code 38 - Trap Function

An internal trap interrupt has occurred, therefore these functions are used only in the hardware development machines and should never occur in a PCAM.

8.7.14 Malfunction Code 20 - Handswitch

The system checks the handswitch input analogue voltage (see IC10-7) for the possibility of a handswitch cable short circuit. If this error occurs look for damage to the handset cable insulation which may represent internal cable damage, Try a different handset and use the self test as described in section 5 above.

If no fault is found in the handset check for a short circuit on the control or power supply PCBs in the handset signal tracking.

8.7.15 Malfunction Code 21 - CRC

The system checks program values stored in the microcontroller internal ROM using a cyclic redundancy code check. If an error is detected in the ROM an error 'Code=21' is set. In this event the microcontroller must be replaced.

8.7.16 Malfunction Code 22 - Stack

The microcontroller software regularly checks the use of the system software stack. In the event of the stack overflowing an error code is set. A microcontroller fault could cause a stack error; in this event the microcontroller must be replaced.

8.7.17 Malfunction Code 23 - Opto

The microcontroller checks the grid, near end of infusion and plunger optos during normal operation. It does this by switching off the opto LEDs and checking that the outputs are off is each case. If an output is not low an opto sensor short circuit is assumed and an error 'Code=23' is set.

Check each of the opto functions in self test - see section 9.5 above.

If no fault is found check that the 0V shield tag is connected to the transmission chassis - some interference can occur from the internal display backlight driver which can cause false 'Code-23' errors.

8.7.18 Malfunction Code 32 - Software Flow Control

This will defect that the internal program flow has been disrupted.

8.7.19 Malfunction Code 33 - RAM

The RAM contents version number may disagree with the map version required by the eprom. If this error code is permanent eg. every time the unit is powered up, the non-volatile RAM contents have been corrupted. The only

Code 17 - an error 'Code=17' can be caused by one of two hardware related faults.

Firstly communication with the display driver could result in this error. The display driver requires certain synchronisation in its communication with the **PCAM** microcontroller. In the event that the display driver appears to be unable to receive data this error can occur (although a non-intermittent display fault will not allow the malfunction message to be displayed).

Second if the motor is seen to be rotating even before the power up motor transistor tests a hardware fault 'Code=17' is reported immediately.

Code 24 - represents a VBAT input signal detected out of normal limits. Check the VBAT signal on the control PCB from PL6-14 to IC5. Also check this signal on the power supply PCB.

Code 25 - represents a video RAM fault. The system checks on a sample basis that it can set and read back data from a variety of locations in the video RAM during power up. A failure caused by incorrect data being read back from the video RAM would cause an error 'Code =25'. If this fault occurs check the display PCB connector location, and trace the display PCB signals from the control PCB. If no fault is found the display module must be replaced.

8.7.13 Malfunction Code 18 - Soft Fault

In normal operation the **PCAM** pump checks certain data and calculations for validity. If data is outside critical limits, for example the system is about to attempt to divide by 0, then a soft fault will occur.

In the event of excessive radio frequency interference or interference caused by electrostatic discharges soft faults could occur in the **PCAM**.

A failure of the microcontroller or its closely associated components such as the RAM could cause Soft Fault errors.

If the above possibilities are eliminated contact the IVAC service centre with clear details of: the protocol in use on the PCAM, together with the drug safety limits which apply and the configuration of all options. Also note the sequence of operation leading up to the error.

8.7.8 Malfunction Code 12 - Amp (continued)

It is possible to cause false alarms in this detection system if the drive plunger restraint is pushed rapidly back and forward - as would not occur in a clinical situation.
Other causes of this error include dropping a pump while it is switched on!

8.7.9 Malfunction Code 13 - Motor Off Failed

The motor drive transistors are checked during power up tests. If motor rotation is not detected when it should be moving a 'Motor On Failed' error will occur.

If a motor rotation error is detected during the power up test the fault probably resides in one of the motor drive transistors. Check for an open circuit fault in transistors TR3, TR4 or TR7 on the control PCB. Also check for shorts that may hold one of these transistors switched off.

8.7.10 Malfunction Code 14 - Motor On Failed

The motor drive transistors are checked during power up tests. If motor rotation is detected when it should not be moving a 'Motor Off Failed' error will occur.

If a motor rotation error is detected during the power up test the fault probably resides in one of the motor drive transistors. Check for a short circuit fault in transistors TR3, TR4 or TR7 on the control PCB. Also check for shorts that may hold one of these transistors switched on.

8.7.11 Malfunction Code 16 - Plunger Stuck

The plunger detect optical switch is continually self tested during normal operation. If a fault is detected in that the optical switch sensor detects light from the optical sensor LED when the LED should be switched off an error 'Code -16' is set.

Check for a stuck output on PL5 pin 14. Also check for a fault in the signal from the optical switch sensor and its connection to IC17 pin 1.

For further investigation see self test section 5 above.

8.7.12 Malfunction Code 17, 24 or 25 - Hardware

The system checks a variety of input and internal conditions which may represent a failure of part of the hardware.

8.7.6 Malfunction Code 10 - VREF

An error was detected in a comparison between the internal ADC power supply in the microcontroller and the voltage reference created by D6 (2.50V). It is essential that the voltage regulator output remain within certain limits specified by manufacturers of the electronic components used on the **PCAM** control PCB.

Check for a failure of IC18, the 5V voltage regulator on the control PCB.

Check that the output of D6 is 2.50V (+/-0.02V) as measured across its terminals and that this voltage is reaching IC5-69.

8.7.7 Malfunction Code 11 - Beam

The occlusion sensing system incorporates a beam with a strain gauge bridge mounted at the end of the leadscrew. The current in the gauge bridge is checked on a continuous basis. The current will fall outside limits if a gauge goes open circuit, or short circuit or if the power wires on the beam connector become open circuit.

If an error occurs check the beam connector wiring connections - crimp connector PL1.

Check the connector wires bonded at the beam end.

Check the small interconnect wires connecting the gauges in a bridge configuration on the beam.

8.7.8 Malfunction Code 12 - Amp

The occlusion sensing amplifier gain is checked on a continuous basis to ensure that it correctly monitors the force applied to the beam. The gain is checked by regularly switching in an offset to the occlusion amplifier input which has a fixed amplitude effect at the amplifier output. If the system detects a significant change in the amplifier gain a 'Code=12' error will occur.

An error may represent only a partial failure of the occlusion amplifier.

Check that the occlusion system detects at the correct point against test gear (4.0kgf with occlusion alarm level 4). If a significant error is observed check the function of the occlusion amplifier at the circuit board level - IC1. Check that IC1-14 detects pressure pushing back on the drive plunger restraint, and IC1-7 detects negative pressures. Check that TR2 is pulsed on every 100ms introducing a small offset into the amplifier output (Ic1-14 while pressure is positive and IC1-7 while pressure is negative).

8.7.4 Malfunction Code 6, 7, or 15 - Watchdog

The microprocessor checks the operation of the watchdog windowing circuit during power up self tests and tests the watchdog output state during normal operation. If an error is detected a malfunction code is set.

Code 6 - the watchdog time interval tested on the microprocessor on power up was found to be slower than the expected period of 17 msecs. Check the following signals :

1. 100ms square wave signal present on pin 5 of IC3.
2. AC coupled reset signal present on pin 12 of IC2.
3. Crystal oscillator of 32kHz on pin 10 and pin 11 of IC2.
4. Check for shorts or failure of IC11 and/or IC12.

Use only a calibrated high impedance probe to measure the signal as severe distortion of the signal will occur if the signal is loaded.

Code 7 - the watchdog time interval tested by the microprocessor on power up was found to be faster than the expected period of 17 msecs. Check the signals as above for code 6.

Code 15 - the watchdog has failed during normal operation because the microcontroller has failed to refresh the watchdog reset within the preset limits. This error could occur under circumstances of extreme radio frequency interference (beyond the specified limits) or interference caused through electro-static discharge for example. If these causes are not suspected check the watchdog circuit operation and signals as for code 6 above.

8.7.5 Malfunction Code 8 - Cover Detect

The cover detect microswitch is checked whenever the drive transmission declutch changes from the engaged to disengaged state. This should only occur when the cover is open on the PCAM. The malfunction code 8 suggests that the drive was declutched while the cover detect reed switch contacts were closed.

If this fault occurs check that the cover detect reed switch contacts are not short circuit when the cover is open - this can be tested in the self test.

If the reed switch is fully functional check the declutch microswitch for maladjustment. If the microswitch is set up wrongly it may trigger a false 'Code=8' malfunction.

Finally check the input to IC9-6 from the reed switch.

Disconnect the flexible circuit from the control PCB, and insert an insulator between the pins and the socket. Ensure there is no syringe in the transmission.

Set the carriage back in the transmission.

Apply the appropriate 24V Voltage DC to the motor connections with the correct polarity (as marked on the flexible circuit near the motor wiring).

Allow the motor to run at full speed while the plunger holder moves about 10mm. This run will clean any oxide deposits from the commutator.

Disconnect the power supply and reconnect the flexible circuit.

Recheck the MOT Vcc current; no 0mA drop-outs during the motor current pulses should be observed.

In the event that an ER4 has not been observed during evaluation to this stage, the pump should be returned to the **IVAC** service centre for further analysis.

Code 9 - the microprocessor has detected an internal fault in the motor which prevents it from controlling at the set rate.

If during previous servicing the motor wiring has been unsoldered from the flexible circuit a code 9 malfunction may mean that the motor is wired in reverse. Check that the motor is wired:

Red wire	'+' motor terminal	unmarked flexible circuit motor connection
Black wire	' -' motor terminal	'+' marked flexible circuit connection.

Note: the flexible circuit connection black wire to flexible circuit '+' is correct.

8.7.3 Malfunction Code 5 - RAM

Code 5 - indicates that the data read from the RAM is invalid.

This could be caused by the RAM not retaining its data when the power is turned off; probably due to a faulty backup battery B1. Check that the voltage across the pins of battery B1 is greater than 2 volts.

3 **If the encoder flag does not rotate** ensure the flag mounted on the rear output shaft of the motor is secure and passes freely through the slots in the optical switches mounted on the motor gearbox assembly.

Check the motor drive rotates as the drive is applied to the motor connections. If not the motor gearbox may have jammed.

4 **Excessive friction may cause intermittent errors**. Possible Sources Of Excess Friction are detailed below.

The transmission may be obstructed internally.

Check that the transmission moves freely, especially in the seal bobbins which fit into the upper case half.

Check that the lead screw is not clogged and is lightly greased.

Check that the leadscrew is not bent. Remove the idler gear from the motor bearing plate; and rotate the leadscrew. Observe the syringe plunger holder for excessive lateral movement as the leadscrew rotates.

Check that the transmission torsion rod is not damaged and the torsion plate is not too tightly clamped to the torsion rod.

Check that the flexible circuit does not foul against the transmission; this could occur if the flexible circuit is not secured correctly.

Check that motor gearbox output shaft is not bent. This would cause the gears to jam against one another. The 'Code=4' would always occur with the gears meshed in the same position.

5 **Intermittent 'Code=4' caused by a dirty motor commutator**. If an error has not been observed in testing to this stage the motor drive voltage and current needs to be checked. Check the motor drive current pulses.

The motor current can be checked with the aid of a current probe and storage oscilloscope. Run the pump with a long clinician background at a rate equivalent to about 90.0ml/hr and measure the current pulses in one of the motor lead wires at the flexible circuit. The observed current pulses should be about 10ms wide, and 30mA - 50mA amplitude.

Small pulses may be present on top of the current pulses. If short pulses appear in the main pulse representing the current falling to the baseline (0mA flowing through the motor) deposits on the motor commutator may be inhibiting current flow. This problem can be characteristic of certain cleaning chemicals in the atmosphere which leave oxide deposits on the commutator.

The commutator can be cleaned in this case using the following procedure:

Current Dead Space: Motor Commutator Cleaning.

4. The 5V supply signal from the control PCB, PL5 pin 10, is present at the optical switches SW4 and SW5.

5. One of the optical switches, SW4 and SW5, mounted on the motor/gearbox assembly could be faulty. Check using the Self Test: Motor Encoders display.

6. The two square wave motor encoder signals are present on IC14 pins 9 and 13, and the inverse of these signals are present on IC14 pins 8 and 12.

8.7.2 Malfunction Code 3, 4 or 9 - Motor Control

Code 3 - Too many motor encoders have been detected in a motor drive period. Check the following :

1. Ensure connections between flexible circuit and control PCB are fully engaged.

2. The flag mounted on the rear output shaft of the motor is secure and passes through the slots in the optical switches mounted on the motor gearbox assembly. Check the 5V supply signal from the control PCB, PL5 pin 10, is present at the optical switches.

3. Check that the two square wave motor encoder signals are present on IC14 pins 5 and 13, and the inverse of these signals are present on IC14 pins 6 and 12.

Code 4 - Not enough motor encoder pulses have been detected in a motor drive period.

This could be caused either because the transmission motor fails to rotate or because excessive friction prevents to motor from maintaining an adequate drive speed. Certain problems can cause 'Code=4' alarms to occur at rare intervals. Since the cause of such errors maybe difficult to identify the following scheme should be followed step by step.

1. Run the pump at 20.0ml/h with no load - fit a syringe barrel under the syringe clamp. If the pump goes 'Code=4' within a few minutes, switch the pump off, and on; start the pump again and check the rotation of the motor encoder flag and the transmission gears. If it does not show 'Code=4' go on to step 2 below.

2 **If the motor encoder flag rotates but the gears do not** then a failure inside the motor gearbox may have occurred. In this case the motor will need to be replaced. Note the large gearbox ratio (485:1) means that the drive will increment very slowly compared to the rotation of the motor encoder.

   Failure of TR3 and/or TR4 is self tested during power up and will appear as an error 'Code=13' or 'Code=14'. So encoder failure should be detected without causing a code 4 malfunction.

8.7.1 Malfunction Code 1 or Code 2 - Grid Speed (continued)

3. Fault in drive from motor. Check that the motor drives the leadscrew. A faulty motor gearbox could be sticking and may be characterised by a clicking sound whilst the motor is running. Similarly a failure in the bonding of the motor output coupling to the gearbox output shaft could allow the gearbox output to rotate without coupling the torque to the transmission.

4. Motor is not being enabled. If the motor does not pulse then check the following :

   - Motor drive +ve on control PCB, IC5 pin 61 is high.
   - Motor drive -ve on control PCB, IC15 pin 12 is high.

5. If the above two are correct then check the respective drive transistor circuits, TR3 and TR4, on the control PCB for correct operation.

6. Check that the drive voltage is actually reaching the motor connections on the flexible circuit.

7. If the motor is powered then check the that the flag mounted on the rear output shaft of the motor is secure and passes through the slots in the optical switches mounted on the motor gearbox assembly. Check that the 5V supply signal from the control PCB, PL5 pin 10, is present at the optical switches. Check that the two square wave motor encoder signals are present on IC14 pins 9 and 13, and the inverse of these signals are present on IC14 pins 8 and 12.

8. Check the linear opto output signal.

   Declutch the transmission, observe the linear speed signal at IC14 pin 1 as the carriage is moved slowly along. This should change as the opto is moves along the linear grid. Check for intermittent connections in the flexible circuit, especially in the joints to the opto LED and detector.

Code 2 - the linear grid has detected that the pump is running too fast for the rate that has been selected.

This could be caused by one of the following :-

1. Ensure the connections between the flexible circuit and control PCB are fully engaged. Also check for intermittent failure of the flexible circuit. Use the Self Test: Linear Grid display and move the transmission slowly, whilst declutched, along the full length.

2. Motor encoder flag slipping on the rear output shaft of the motor/gearbox assembly. Check that the flag is secure.

3. The flag mounted on the rear output shaft of the motor is secure and passes through the slots in the optical switches mounted on the motor gearbox assembly.

8.6.9 Cover Opened False Alarm

The cover detect alarm is triggered if the **PCAM** cover is opened while the pump is running (start LED lit or flashing). In changing a syringe for example the normal procedure is to press STOP before opening the cover to prevent a cover opened alarm occurring.

If a fault in the cover detect mechanism is suspected use the self test - as described in section 8.5 above for further analysis.

8.6.10 Handset Removed False Alarm

The handset removed alarm operates only when a handset is removed from the **PCAM** after the pump has been started (start LED lit or flashing). The pump can be started without a handset if required but once one is plugged in an alarm will be triggered if the PCA is not stopped before the handset is removed from its connector.

If a fault in the handset sense system is suspected use the self test - as described in section 8.5 above for further analysis.

8.7 Malfunction Codes

Any **PCAM** pump with a malfunction code should be removed from use and investigated for the cause of the fault. The diagnosis schedule below is a guide only and faults other than those described below may cause a malfunction code.

The 10 most recent malfunction codes can be reviewed in the PCAM using the service log: displayed by using the access code: **'3 7 6'**. Do not reset the service log until the fault has been fixed in case the pump requires investigation by an IVAC service centre.

8.7.1 Malfunction Code 1 or Code 2 - Grid Speed

Code 1 - Motor too slow, the linear grid has detected that the pump is running too slow for the rate which has been selected, and motion over the linear grid is less than expected given the number of motor revolutions detected.

This could be caused by one of the following :

1. The transmission is obstructed. Check that the transmission moves freely.

2. Ensure connections between flexible circuit and control PCB are fully engaged.

8.6.5 Syringe Empty Or Near End Of Syringe False Alarm

First check normal function of the Near End Of Infusion detector, and adjust the setup if necessary - see Section 9.2.

If the 'EOI' alarm occurs well away from the normal end of infusion point check the connections between the NEOI opto, along the flexible circuit, onto the control board.

If the alarm occurs intermittently check for an intermittent failure in the flexible circuit.

8.6.6 Plunger Location False Alarm

The plunger must be correctly located in the plunger restraint mechanism before the location is confirmed. Is easier with small syringes (eg. 20ml syringes) not to locate the plunger correctly or not to take up any slack in the drive which can then result in a plunger location alarm.

If the plunger sensor is suspected faulty check using the self test - see section 8.5 above.

8.6.7 Syringe Location False Alarm

If the 'Syringe Location' warning message is given when the pump is running an infusion it generally means that the syringe clamp has been moved or that a fault has occurred with the syringe size detection system.

Remove the syringe from the pump and check that the clamp moves up and down without sticking or catching.

Perform the self test function and check the syringe size test - see section 8.5 above.

8.6.8 Respiration Alarm False Alarm

The respiration input is part of the isolated interface board which allows a respiration monitor with an alarm output relay to shut down PCA if required. The input is normally inactive when no input is connected to the 9-pin D type interface connector. If pin 1 is pulled to GND (pin 5) the alarm input becomes active and will trigger a respiration alarm if PCA is started.

If false alarms occur check the connector signals applied to the 9-pin D type interface connector.

Check the signal at R2 on the interface PCB is not active (ie is at 0V isolated).

Check the signal at the other side of the isolation barrier at OP7-5, connected to PL2-10 and onto the control PCB.

8.6.3 Drive Disengaged False Alarm

The drive disengaged alarm would normally sound if the pump were running and the drive was not engaged properly. The engagement is detected by a microswitch fitted on the transmission which is operated by a pin mounted in the half-nut. The engagement operation can be checked initially by listening for the switch click which should occur as the declutch lever is moved. The switch should click between the lever end moving about 3mm to 6mm. If the microswitch is incorrectly set it may be too sensitive and cause false alarms. Check electrically as detailed in section 9.

Check the connections between the microswitch and the control board, particularly checking for intermittent failure in the flexible circuit.

Check that the wires to the microswitch do not foul on the microswitch actuator arm; and are not squashed at the extremities of the transmission.

8.6.4 Line Occlusion False Alarm

The occlusion alarm detects excessive force measured in the beam mounted behind the transmission. The occlusion default alarm level is normally level 4 - see Self Test, and User Defined Options, Default Pumping Pressure Alarm Level (Section 8).

The occlusion sensing system must also calibrated correctly to ensure false alarms are not triggered. Before further fault finding check the occlusion calibration as set out in section 9. If necessary recalibrate the occlusion sensing system. If it is not possible to calibrate, the electrical connections and signals need to be checked as below.

Check for damage to the beam which could have occurred if the pump were dropped. Such a problem could show up as a base level shifted outside the limits -020 to +020.

Check for excessive force being set up due to misalignment in the transmission (possibly due to the pump being dropped). Check the free movement of the transmission, particularly for the presence of dried fluids or any other foreign bodies which may prevent its free movement.

If the Occlusion alarm still occur check the signals from the strain gauges mounted on the beam. Check the connections between the strain gauges and the control board, including the crimp contacts. Check the signal path to IC5 on the control board.

8.6 False Alarms.

A false alarm will most likely be characterised by a repeated alarm code which appears to occur at unexpected times.

8.6.1 Low Battery False Alarm

The PCAM system checks the battery voltage at power up and during battery operation.

At power up if the internal power supply voltage is below 5.65V the unit will alarm showing Low Battery on the display a prevent normal operation of the unit. Under these circumstances the unit must be plugged into the ac mains for operation and to restore charge to the internal battery.

During normal operation when running from its internal battery if the voltage on the internal power supply falls below 5.50V the unit will alarm Low Battery and begins to time the last 30 minutes of operation before the battery becomes exhausted and the unit stops operating alarms.

If false low battery alarms are suspected check the internal voltage being measured by the PCAM using the self test - see section 8.5.1 above.

Check that the internal lead acid battery is holding its charge and terminal voltage and if necessary replace the battery.

8.6.2 AC Power Fail False Alarm

The ac power fail alarm warns that the pump was running from ac mains power which has now been disconnected. The alarm self cancels if ac power is restored.

If false alarms occur check the connection of the ac power cord is not intermittent outside the unit; also check the connection of the mains inlet connector to PL1 on the power supply PCB.

Check the fuse FS1 is fitted, not blown and of the correct value.

Further checks include measuring the power supply secondary voltage at D2, D3 connection end.

8.5.14 Handswitch Detection Test

The handswitch state is determined by a voltage generated at IC10-7. The following voltages represent different states. Check that these occur and if not trace the voltage from the handset connector PL4 on the power supply PCB through to IC10-7 and onto IC5-72.

Handswitch State	Voltage IC10-7
Disconnected: ' - '	more than 4.0V
Patient switch off: 'OFF'	3.0V to 4.0V
Patient switch on: 'ON'	2.3V to 3.0V
Handset cable short circuit: 's/c'	less than 2.3V

If the fault is not determined check with another working handset that the fault does not exist within the handset itself - if so replace the handset.

8.5.15 Keyswitch Detection Test

The keyswitch position is determined by the electrical switch connected to the rear of the key mechanism. The switch has three positions - power off, power on with KS0 on PL6-1 low, and power on with KS0 on PL6-1 high.

Check that in the self test the key switch shows 'SET' and 'RUN' in the appropriate positions.

If is does not check the following:

1. KS0 signal at PL6-1 switches state as the keyswitch is turned.

2. Check for a failed connection between the keyswitch and PL2 on the power supply PCB.

8.5.13 Pumping Pressure Measurement System Test

The display will show the base level of the pumping pressure measurement system and should be in the range -020 to +020. To test operation gently press back on the plunger holder and observe the value increase. If the value is outside the set limits or it does not change with pressure then check the following:-

1. The connections between the beam assembly and the control PCB connector, PL1, are fully engaged. Check for failure of crimp connections - it is likely that these failures would cause an Er11 BEAM failure during normal operation.

2. The transmission is free to move when pressure is applied.

3. The output from the instrumentation amplifier, IC1-8, rises when pressure is applied.

Refer to the circuit description in section 4 and the control PCB circuit diagram for further information.

After making any adjustments to the pressure measurement system recalibrate it as described in the Technical Service Manual section 9.

8.5.11 Cover Detect Test

The cover detection mechanism involves a reed switch fixed to the underside of the control PCB behind PL5 (flexible circuit connector) and a magnet housed on the edge of the polycarbonate cover.

As the cover is opened and closed the test should show '1' closed, and '0' open.

If it does not check the following:

1. Check the magnet housing is not misaligned and that the cover is closing and latching correctly.

2. Check that the reed switch is operating - a click can be heard in a very quiet ambient noise level.

3. Observe the reed switch signal on R46 being pulled to 5V when the cover is open and to 0V when the cover is closed and the reed switch operates.

4. Check the voltage at IC9-6 represents the reed switch state.

8.5.12 Syringe Size Measurement Test

The display will show the current value read from the syringe size detection system. With the clamp at the bottom of its travel the value should be in the range 000 to 060. With the clamp at the top of its travel the value should be in the range 140 to 250.

Check the internal mechanism, ensuring that the linear potentiometer runs freely and in sympathy with the syringe clamp shaft.

If the displayed value does not change when the syringe clamp shaft is moved, then check the following:

1. The connection between the linear potentiometer and the control PCB connector PL6 is fully engaged and the wiring connections are not damaged.

2. The syringe clamp shaft moves freely in the case and the slide on the linear potentiometer moves with it.

3. The output from the unity gain amplifier IC16 pin 1 changes as the input changes. Using a DVM measure the output voltage from the syringe sizing amp, IC10 pin 1 and ensure that varies between 1V and 4V.

After making any adjustments to the mechanism recalibrate the syringe size detection system as detailed in the Technical Service Manual section 9.

8.5.9 Plunger Detect Test(continued)

5. If the fault is not identified above investigate for damage to the flexible circuit inside the transmission outer tube by dismantling the transmission.

8.5.10 Motor Encoder Test

The display will show the status of the motor encoders as 0, the motor will then pulse and the display should indicate 1 to show that the encoders are functioning.

If the motor does not pulse then check the following:

1. Motor drive +ve on control PCB, IC5-61 pulses high to switch on TR3.
2. Motor drive -ve on control PCB, IC15-12 pulses high to switch on TR4.
3. Watchdog inhibit is not active, IC3-8 is high switching on TR7.
4. If the above are correct then check the respective drive transistor circuits, T3 and T4, on the control PCB for correct operation.
4. Ensure connections between flexible circuit and control PCB are fully engaged.
5. Check that the drive voltage is actually reaching the motor connections on the flexible circuit.

If the motor is enabled but the display does not change then check the following:-

1. Ensure connections between flexible circuit and control PCB are fully engaged.
2. The flag mounted on the rear output shaft of the motor is secure and passes through the slots in the optical switches mounted on the motor gearbox assembly.
3. The 5V supply signal from the control PCB, PL5 pin 10, is present at the motor encoder optical switches.
4. The two square wave motor encoder signals are present on IC14 pins 9 and 13, and the inverse of these signals are present on IC14 pins 12 and 8.
5. Check that the signal from IC14 pin 8 is inverted to feed IC14 pin 10.

8.5.8 Linear Grid Test

The display will show the status of the linear grid sensor.

Declutch the transmission and move the plunger holder very slowly along and check that the display changes from 0 to 1 and back again.

If it does not then check the following:

1. The grid has not become dislodged.

2. The grid is passing through the slot in the linear speed optical switch SW2.

3. Ensure connections between flexible circuit and control PCB are fully engaged.

4. The 5 Volts supply signal from the control PCB, PL5-10, is present at the optical switch SW2, which passes over the linear grid, on the flexible circuit solder joint nearest the case and nearest the exposed leadscrew.

5. Check signal on control PCB at IC14-2 changes state when you block the beam of the linear speed optical switch.

8.5.9 Plunger Detect Test

The syringe plunger is detected by a button in the plunger holder which is sprung out when no syringe is fitted. The test shows '1' under these conditions. When the button is pressed in fully the test should show '0' indicating a properly located syringe plunger.

Press the plunger button in and release it again - check the display changes from '1' to '0' and back again.

If it does not check the following:

1. The button is not stuck either in or out. If suspected the plunger backplate can be removed to investigate without fully dismantling the transmission.

2. The plunger opto 5V supply is present on PL5-4.

3. The plunger opto output signal switches state at PL5-14 and feeds via IC17-1, is inverted and is present at IC9-5.

4. If no signal is found at PL5 check the flexible circuit connector, assess for damage to the flexible circuit, and check the solder connections to the plunger detect flexible circuit made on the side of the half nut housing/carriage block.

8.5.6 Declutch Test

The declutch switch test will indicate the status of the declutch switch. When the transmission is engaged the display will show 1 and when dis-engaged 0.

If the display does not change its state when the declutch lever is squeezed check the following:

1. The wiring to the microswitch on the transmission is intact.

2. The connections between the flexible circuit and the control PCB are fully and correctly engaged.

3. The microswitch activates when the unit is declutched, if not then adjust the microswitch mounting plate so that it does. The switch will click audibly as it changes state.

4. The 5 volts supply signal from the control PCB, PL5-4, is present at the microswitch.

5. If the above are all correct check the signal path on the control PCB. The declutch signal should change state at IC17-3 when declutched and the inverted signal do the inverse at IC17-4.

8.5.7 Near End Of Infusion Test

The display will indicate the status of the EOI opto. When the transmission is moved to the right the display will show 0, when the transmission is moved upto the EOI position and beyond the display will show 1.

If it does not follow the above sequence then check the following:-

1. Is there anything blocking the slot in NEOI optical switch SW3.

2. Ensure the connections between flexible circuit and control PCB are fully engaged.

3. Check the operating point of the NEOI flag (see Technical Service Manual section 9).

4. The 5V supply signal from the control PCB, PL5-13, is present at the optical switch, on the flexible circuit solder joint, furthest from the upper case and nearest the exposed leadscrew.

5. Check that the signal on the control PCB at IC14-6 changes state when you block the beam of SW3.

3. Check the display control signal lines on the control PCB PL2 for short/open circuits.

8.5.3 Display Test (Including Backlight) continued

If the backlight fails to illuminate check the following:

1. The continuity of the connections between the backlight and control board.

2. The backlight tube.

3. The backlight inverter power supply on the control PCB - see circuit descriptions in the Technical Service Manual.

If the backlight illuminates but fails to dim check the following:

1. IC5 drives 5V onto R71 when the backlight should be dim and that this voltage feeds about 3V via D12 to offset the control input of IC8.

8.5.4 Switch Test

The display will prompt for each button to be pressed in turn starting with the START button and ending with the PURGE button. If the button operates correctly an audible bleep will be heard and the display will prompt for the next button to be pushed.

If a button is constantly on the alarm will sound continuously. Trace through the buttons until the faulty one is found.

Check that the front panel is not lifting or bulging.

Check that the tactile feel of the switch functions correctly. If not check that the switch spacers are all present between the display board and front panel. This is only likely to be a problem if the display board has been removed from the pump and one or more switches then fail to function. Switches held down would be identified during self test.

Check that there is nothing preventing normal operation of a switch and if not then remove the display board and replace the switch.

8.5.5 LED Test

The START and STOP LEDs only should flash (the battery and ac leds function dependant upon the power supply connected). If either led is always on or always off check the drive signals on the control PCB from IC15 and the tracks on the display board too.

The following sections provide guidelines to identifying the cause of the problem should the particular test fail.

8.5.1 Internal Voltage Test

The display shows the internal power supply voltage as measured by the PCAM. On mains this voltage will be in the region of 9.00V; while on internal battery it will be in the range 5.20V to 6.50V. Note: the internal power supply voltage is slightly lower than the actual battery terminal voltage.

If the voltage displayed appears to be near 0.00V check the connection of the measured voltage between PL6-14 and IC5-73 on the control PCB and between PL5-14 and resistor chain R9, R10 and R14 on the power supply PCB.

If the voltage displayed appears to be near 15.00V check for a short circuit to 5V on the control PCB on the measured signal track running to IC5-73.

If the voltage appears inaccurate check against a DVM with the negative lead on the control PCB AGND on C42 or D6 (LT1009CZ) and the positive lead on the power supply PCB VIN end of R14. The voltage at R9/R10 should be exactly 1/3rd the VIN voltage.

8.5.2 Audible Alarm Test

The alarm will sound continuously. If no alarm is heard, open unit and check the following:-

1. The continuity of the connections between the power supply board and alarm.

2. That the alarm signal between R5 and R7 on the power supply PCB is high (approx. 5V).

3. Alarm drive signal at IC5-4 on the control PCB is low.

8.5.3 Display Test (Including Backlight)

When the display test is running check that all the pixels of the display turn on and off and that the backlight dims when indicated.

If segments of the display fail to turn on and off correctly check the following:

1. That the contrast adjust on the rear of the display board is set correctly. If the contrast is set too high the display will darken as the unit warms up.

2. The inter connections between the display board and control board (PL2 and PL4 control board).

8.4 Pump Will Not Operate From Battery And/Or From AC Mains

8.4.1 Pump Will Not Operate From Battery

If the pump will not power up from the internal battery, check that the battery has been charged for at least 2 hours. The battery terminal voltage should exceed 6.0V. Check continuity of the battery fuse FS2 on the Power Supply Board. The fuse is a board mounted device of a similar shape to a resistor. Check the continuity of the battery connection wires and associated crimped connector contacts.

8.4.2 Pump Will Not Operate From AC Mains

First check the function of the mains cable with another piece of working equipment. Check that the mains is switched on at the wall outlet. Check that the power cord is seated properly in the mains inlet.

If the AC indicator does not light when the pump is connected to a live AC cable check the mains fuse FS1 mounted in the fuse holder on the Power Supply Board. Trace the power from the transformer secondary through the bridge rectifier D2. Check for a voltage on R12 on the Power Board which supplies the AC Power LED. Refer to the Technical Service Manual Power Supply Board circuit diagram.

8.5 Self Test Functions

All **IVAC** syringe pumps incorporate a number of self test and monitoring routines within the resident software to assist in the detection and rectification of any faults in the units' operation.

Before carrying out any detailed diagnosis of reported faults, perform the self test routine described below.

The self test routine was designed so that the correct operation of the main functions of the syringe pump can be confirmed without having to physically open the unit.

If at any stage during the self test the unit does not perform as expected, this section can be used to help identify the problem.

To enter the self test routine:-

To enter the self test routine:-
o Ensure that the Key Switch is in the **OFF** position.
o Hold down **START** button and turn the Key Switch to the **SET** position.
o Display will show **'ACCESS CODE 0 0 0 '**. Enter **1 2 4** using the ⇑**+**, ⇓ **-** and ⇑ **NEXT** buttons.
o Press ⇑ **NEXT** to commence the self test routine.

8.1 Safety First - WARNINGS

Use extreme caution when servicing equipment whilst it is connected to the AC mains. Hazardous voltages are present at the mains inlet and on the power supply board even when the pump is switched off.

The internal battery can deliver high electrical current, especially if its connections are shorted in between the battery and the power board battery fuse. Disconnect the battery and AC power whenever removing or inserting PCBs or other connectors.

This equipment contains static-sensitive components. Observe strict precautions for the protection of static-sensitive components when attempting to service and repair the equipment.

Always visually inspect the pump, power cord and plug for damage. If the power cord or plug are damaged they should be replaced.

Should further technical assistance be required call your local IVAC service centre.

8.2 Pump Dropped Or Damaged

If the pump is damaged, the damaged parts should be identified and replaced before any further troubleshooting is carried out.

During inspection pay careful attention to the upper and lower case halves which can be damaged if the pump is dropped from a height. Damage to these parts can interfere with the correct function of the pump transmission and therefore result in a variety of error codes.

8.3 Pump Exposed To Fluids

Excessive fluid spills can lead to fluid ingress into the pump. Even if the fluid dries out deposits can be left which cause the pump to fail.

If fluid ingress is suspected the pump should be inspected internally. Clean and dry out the pump. Take care to ensure dried out deposits do not remain on the PCBs or other electrical components.

Section	Self Test
8.5.1	Internal Voltage Test
8.5.2	Audible Alarm Test
8.5.3	Display Test (Including Backlight)
8.5.4	Switch Test
8.5.5	LED Test
8.5.6	Declutch Test
8.5.7	Near End Of Infusion Test
8.5.8	Linear Grid Test
8.5.9	Plunger Detect Test
8.5.10	Motor/Encoder Test
8.5.11	Cover Detect Test
8.5.12	Syringe Size Measurement Test
8.5.13	Pumping Pressure Measurement System Test
8.5.14	Handswitch Detection Test
8.5.15	Keyswitch Detection Test

Section	Alarm Displayed
8.6.1	Low battery
8.6.2	AC power fail
8.6.3	Drive disengaged
8.6.4	Line occlusion
8.6.5	Syringe empty or near end of syringe
8.6.6	Plunger location
8.6.7	Syringe location
8.6.8	Respiration alarm
8.6.9	Cover opened
8.6.10	Handset removed

Section	Malfunction Displayed	Malfunction Code(s)
8.7.1	Grid Speed	1, 2
8.7.2	Motor Control	3, 4, 9
8.7.3	Ram	5
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8.7.5	Cover Detect	8
8.7.6	Vref	10
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8.0 TROUBLESHOOTING

If you experience problems with an **IVAC PCAM** syringe pump use the trouble shooting table below to help identify the cause of the problem; then read the details in the appropriate section.

If the problem is unclear step through the self test, to check the correct operation of the main functions of the syringe pump.

Before beginning diagnosis read the safety warnings section 8.1.

Section	Fault Description
8.2	Pump dropped or damaged
8.3	Pump exposed to fluids
8.4	Pump will not operate from battery and/or from ac mains
8.5	Self test functions - SEE SELF TEST TABLE BELOW
8.6	False alarms - SEE ALARM TABLE BELOW
8.7	Alarms with malfunction code - SEE MALFUNCTION TABLE BELOW
8.8	Pump delivery rates suspected excessive/variable/low
8.9	Power-up continuous alarm with abnormal display
8.10	Pump runs normally and resets after a time

9.11 CALIBRATION AFTER REPLACING INTERNAL RAM OR RAM BATTERY

If the internal RAM or its associated battery is replaced on the Control PCB it will be necessary to recalibrate the complete unit. Initially however the unit will not power up until the RAM is cleared.

Warning: Do not clear the RAM unless absolutely necessary, because all calibration and configuration in the pump will be cleared.

To clear the internal RAM:

1. Ensure that the keyswitch is in the **OFF** position.

2. Hold down the **START** button and turn the keyswitch to **SET.**

3. The display will read **'ACCESS CODE 0 0 0'.** Enter **611** using the ⇧**+**, ⇩**-** and ⇧ **NEXT** buttons.

4. Turn the keyswitch to **OFF** and then to **SET,** ensuring that the unit performs the normal power up sequence.

Set the unit options as required from the list shown in the Directions For Use manual

Then calibrate the syringe size measurement detection system (section 9.4), and the occlusion calibration system (section 9.5). Finally perform a full self test.

9.10 SYRINGE CONSTANTS FOR LINEAR PERFORMANCE TESTING

Syringe Type	Syringe size	Diameter (mm)	mm/ml
B-D Plastipak	50ml	26.33	1.84
	30ml	21.38	2.79
	20ml	18.90	3.56
Terumo	50ml	28.76	1.54
	30ml	23.00	2.41
	20ml	20.00	3.18
B.Braun Omnifix	50ml	27.52	1.68
	30ml	22.07	2.61
	20ml	19.94	3.20
B.Braun Perfusor	50ml	27.80	1.65
Fresenius Injectomat	50ml	29.20	1.49
Sherwood Monoject	50ml	26.60	1.80
	30ml	23.44	2.32
	20ml	19.99	3.19
Rapiject	50ml	27.22	1.72
RR Pronto	50ml	29.20	1.49
	30ml	23.65	2.28
	20ml	21.20	2.83
ONCE	50ml	27.85	1.64
IVAC	100ml	37.82	0.89
	50ml	26.31	1.84
BD World Wide	50ml	26.31	1.84
	30ml	21.36	2.79
	20ml	18.99	3.53
Janpol	50ml	27.53	1.68

9.9 BATTERY CHARGING

If the battery charging circuitry on the power supply PCB has been repaired the following sequence should be carried out to ensure that the battery can be charged correctly.

Field replacement power supply PCB assemblies are supplied from **IVAC** with the charging voltage set to the correct value. The procedure below can be followed in order to check the setting if deemed necessary.

1. Ensure that the unit is turned off and disconnected from the AC power supply.
2. Obtain access to the unit as detailed in section 8.
3. Disconnect battery connector, PL3, from the power supply PCB.
4. Connect an oscilloscope to measure the DC voltage on PL3 (0V to pin 1).
5. Set the range on the oscilloscope to be able to display 0 to 7 Volts DC.
6. Connect the unit to an AC power supply.
7. Adjust RV1 on the power supply PCB until the peak voltage level displayed on the oscilloscope is 7.0 Volts +/-0.1 Volts.
8. Seal RV1 to avoid battery charge level changing.
9. Disconnect the AC power supply, remove the oscilloscope connections and refit the battery connector.

Table 9.8
Linear Accuracy Table
The following table of times relate to a specified distance travelled of 10.00mm.

Syringe Type	Size (ml)	Flow Rate (ml/hr)	Expected Time (min:sec)	Tolerance (1%) (+/- sec)
BD Plastipak	20	20.0	08m 30s	06s
	30	20.0	10m 46s	07s
	50	20.0	16m 21s	10s
Terumo	20	20.0	09m 26s	06s
	30	20.0	12m 28s	08s
	50	20.0	19m 29s	12s
Braun Omnifix	20	20.0	09m 19s	06s
	30	20.0	11m 28s	07s
	50	20.0	17m 50s	11s
B. Braun Perfusor	50	20.0	18m 12s	11s
Fresenius Inject.	50	20.0	19m 29s	13s
Sherwood Monoject	20	20.0	09m 25s	06s
	30	20.0	12m 56s	08s
	50	20.0	16m 21s	10s
Rapiject	50	20.0	17m34s	11s
RR Pronto	20	20.0	10m 35s	07s
	35	20.0	13m 10s	08s
	50	20.0	16m 21s	10s
ONCE	50	20.0	17m 48s	11s
IVAC	50	20.0	16m 21s	10s
	100	20.0	33m 08s	21s
BD World Wide	20	20.0	08m 30s	06s
	30	20.0	10m 46s	07s
	50	20.0	16m 21s	10s
Janpol	50	20.0	17m 51s	11s

9.8 LINEAR SPEED

The linear accuracy of the pump can be checked by measuring the time that the plunger holder takes to travel a specified distance.

The distance travelled can be measured using a dial indicator which can be mounted in place of the syringe and the elapsed time can be measured using a stop watch.

To test the linear drive accuracy use test gear 0000TG00002 and 0000TG00032 (magnet) or equivalent and follow the procedure below:

1. Declutch the drive mechanism and move the plunger holder to the right.

2. Fit the linear test gear 0000TG00002 to the pump and 0000TG00032 to the cover clip position and move plunger holder towards dial gauge until it is a about 3mm clear of the probe.

3. Turn the keyswitch to **SET** and configure the pump to run at a continuous rate of 20 ml/hr. Press **START**.

5. Allow the unit to run until it touches the probe and then using a stop watch, time the travel over a distance of 10.00mm.

6. Using the values specified in Table 9.8, check that the unit is travelling at the correct speed.

7. If the test values fall outside the stated limits then reject the unit for further investigation.

8. Switch the unit **OFF** and remove the test gear.

Note that data for a combination of rates and syringe sizes have been provided should further testing be deemed necessary. It is not normally necessary to test for all the combinations provided.

9.7 REVIEW OCCLUSION CALIBRATION

The occlusion calibration values are stored in non-volatile memory on the control PCB. These values are read by the microprocessor when the unit is powered up.

In the event that it is necessary to validate the values stored during the occlusion calibration procedure they can be viewed by accessing page 1 of the self test routine.

If necessary carry out the occlusion calibration and test the pump using the procedures set out in sections 9.5 and 9.6.

Table 9.6.1
50/60ml Syringe Occlusion Test Limits for the PCAM with occlusion alarm level set to L4

Syringe Type	Alarm Level (Kgf)	Lower Limit (Kgf)	Upper Limit (Kgf)
BD Plastipak	3.5	3.1	3.9
IVAC	3.9	3.5	4.4
Terumo	6.5	6.0	7.0
Braun Omnifix	4.1	3.7	4.5
Braun Perfusor	4.0	3.6	4.4
Sherwood Monoject	3.9	3.5	4.4
R.R Pronto	5.7	5.2	6.2
Rapiject	3.3	2.8	3.7
BD Worldwide	3.6	3.2	4.1
Once	3.9	3.5	4.4
Fresenius Inject	5.7	5.3	6.1

IMPORTANT

N.B: ALARM LEVEL FOR V2R6 SOFTWARE WITH BD 50 SYRINGE IS 3.5 FOR ALL PRECEDING SOFTWARE, ALARM LEVEL IS 3.9kgF. THIS SYRINGE ONLY.

DUE TO VARIATIONS IN SYRINGE MANUFACTURE, SOME DEVIATIONS FROM THE ABOVE FIGURES MAY BE EXPERIENCED WHEN TESTING THE OCCLUSION ALARM BY MEANS OF A LINE PRESSURE MEASURING DEVICE. CERTAIN SYRINGES WILL ATTAIN A 10KGF DRIVE FORCE BEFORE A HIGH OCCLUSION LEVEL IS REACHED.

9.6 OCCLUSION TEST AND LIMITS FOR THE IVAC PCAM

To test the **PCAM** occlusion alarm levels use test gear 0000TG00020 and 0000TG00032 and follow the procedure below:

1. Declutch plunger holder and move to the right.

2. Fit occlusion test gear 0000TG00020 to the pump and 0000TG00032 (magnet) to the cover clip position, move the plunger holder towards the test gear actuator pad, leaving the plunger holder just clear of the actuator pad.

3. Set the pump to run at a continuous rate of 20ml/hr and press **START**.

5. When the pump indicates line occlusion and alarms press **STOP.**

6. Read the occlusion level from the test gear dial and check that the unit alarms at the desired level. See Table 9.6.1.

7. If outside the stated limits then repeat the occlusion calibration procedure and re-test otherwise declutch, remove the test gear and switch **OFF.**

The values shown in Table 9.6.1 are for 50/60ml syringes only.

The alarm level for each syringe type is equivalent to 375mmHg line pressure, with the limits being +/- 50mmHg of this point.

In the event that it is necessary to validate the values stored during the syringe size calibration procedure they can be viewed by accessing the self test routine. If necessary syringe size calibration can be performed as detailed in section 9.3.

9.5 OCCLUSION CALIBRATION

To set up the occlusion alarm level for pumps, use occlusion test gear 0000TG00020, 0000TG00032 and 0000JG00014 :

1. Ensure that the keyswitch is in the **OFF** position and that there is no syringe fitted to the pump.
2. Hold down the **START** button and turn the keyswitch to the **SET** position.
3. The display will read **'ACCESS CODE 0 0 0'.** Enter **717** using the ⇑+, ⇓- and ⇑ NEXT buttons.
4. The display will show **'Base level 0Kgf (typ. -006..+006) :** xx' where xx is the current reading from the pressure monitoring system in hexadecimal format.
5. Press ⇑**OK** to start the drive and allow it to run for approximately 30 seconds to enable the zero pressure level to settle.
6. Check that the pressure reading is in the specified range. If it is not open up the case and adjust VR1 on the control PCB until it falls in the desired range, (-006 to +006 decimal). Typically the base level is set to 000.
7. Press ⇑**CALIBRATE** to store the zero pressure level.
8. Fit the occlusion test gear 0000TG00020 to the pump and 000TG00032 (magnet) to the cover clip position, move the plunger holder towards the dial gauge until it is just clear of the pad.
9. Press ⇑**NEXT**. The pump will display **'Test gear 4.0Kgf (+050..+100) :** xx'. Allow the pump to run until the dial gauge on the test gear reads 4Kgf.
10. Press ⇑**CALIBRATE** to store the 4kgf level. The display will read **'Difference 0kgf to 4.0kgf :** xx'. Where xx is the difference in decimal format.
10. Press ⇑**QUIT** to return to normal operation of the pump.

If Software revision greater than V2R5 follow this section after point 9.

1. Turn key to off position and then turn to run position for normal operation.

9.3 SYRINGE SIZE MEASUREMENT DETECTION SYSTEM CALIBRATION

The syringe size detection system stores the characteristics of the syringe clamp assembly, including the travel of the linear potentiometer in non-volatile memory and allows automatic compensation for the mechanical tolerances and variances.

Should the syringe clamp assembly or any of its constituent parts be disassembled or changed this calibration will need to be carried out before the unit can be put into use.

To calibrate the syringe size detection system, it will be necessary to use the syringe size calibration spacer Part Number 0000TG00055.

1. Enter the access code 243.
2. The display will show **'Clamp Down: xx'** where xx represents the current decimal reading from the linear potentiometer.
3. Position the narrow end of the syringe size calibration spacer (0000TG00055) under the syringe clamp in the place where the syringe would normally fit. Ensure the wider end of the spacer overhangs above the outer tube , and that there is adequate clearance so as to provide no interference with the outer tube seal. Check the value is within the tolerance band displayed on the screen.
4. Press ⇑**CALIBRATE** to enter the base value.
5. Leaving the spacer in the same orientation and position, press ⇑**NEXT.** The display will read 'Fit spacer (typ. 170..210): xx' where xx represents the current decimal reading from the linear potentiometer.
6. Position the wider end of the syringe size calibration spacer (0000TG00055) under the syringe clamp in the place where the syringe would normally fit, again ensuring the end of the spacer overhangs above the outer tube, and that there is adequate clearance so as to provide no interference with the outer tube seal. Check the value is within the tolerance band displayed on the screen.
7. Press ⇑**CALIBRATE** to enter the value.
8. The display will read 'Difference (19mm): xx' where xx is the value that has been stored. Record the three values on the test sheet.
9. Press ⇑**QUIT** to return to normal operation of the pump.

If Software revision greater than V2R5 follow this section after point 8.

1. Turn key to off position and then turn to run position for normal operation.

9. 4 REVIEW OF SYRINGE SIZE CALIBRATION.

The syringe size calibration values are stored in non-volatile memory on the control PCB. These values are read by the microprocessor when the unit is powered up.

Table 9.2
Reference syringes for IVAC PCAM Syringe Pump :
Use the following syringes for setting up.

Syringe Type	Syringe Size (ml)	EOI Point (ml)
BD Plastipak	50	5.5
IVAC	50	6.0
Terumo	50	3.0
Braun Omnifix	50	5.0
Sherwood Monoject	50	5.5
R.R Pronto	50	7.5
Rapiject	50	3.0
BD Worldwide	50	6.5
Once	50	4.5
Fresenius Inject	50	5.0
Braun Perfusor *	50	3.0
Janpol *	50	3.0

* **Note:** These syringe types can only be used if the pump is fitted with the correct options kit.

9.2 PROCEDURE FOR SETTING UP THE NEOI POSITION :

1. Open the unit as detailed in section 7.

2. Ensure that the Keyswitch is set to the **OFF** position.

3. Hold down the **START** button and turn the Keyswitch to **SET**.

4. The display will read **'ACCESS CODE 0 0 0'**. Enter **126** using the ⇧**+**, ⇩**-** and ⇧ **NEXT** buttons.

5. Using the ⇧ **NEXT** button step through the self test routines until the display reads **'EOI opto:** x'. Where x is the current status of the EOI detector.

6. Move the plunger holder to the right. The display will read **'EOI opto: 0'**

7. Fit the appropriate syringe selected from Table 9.2 and move the plunger holder to the desired EOI position.

8. Separate the lower and upper case of the pump and adjust the position of the EOI actuator on the bottom of the carriage to the desired position, so that the EOI status changes from 0 to 1 at the position set in Table 9.2.

9. Move the plunger holder and observe that the display changes from 0 to 1 as the syringe passes the EOI position.

   If it does not repeat from step 6.

10. Fit and fasten the case halves together and check the end of infusion point again.

9.1 SYRINGE TYPE SELECTION

The PCAM can be configured to use one of three standard disposable syringe sets as follows:

Syringe Set	Syringe Types	Size (ml)	Comments
UNIVERSAL	B.D Plastipak	20, 30, 50	
	Terumo	20, 30, 50	
	Braun Omnifix	20,30,50	
	Fresenius Injectomatic	50	
	Sherwood Monoject	20, 30, 50	
	Rapiject	50	
	R.R Pronto	20, 35, 50	
	ONCE	50	
	IVAC	50, 100	
	B.D Worldwide	20,30,50	
BRAUN PERFUSOR	Braun Perfusor	50	With BRAUN options kit.
JANPOL	Janpol	50	With JANPOL options kit.

Before selecting the syringe set ensure that the required options kit is fitted to the pump, then follow the procedure below.

1. Ensure that the keyswitch is in the **OFF** position.
2. Hold down the **START** button and turn the Keyswitch to **SET**.
3. The display will read **'ACCESS CODE 0 0 0'**. Enter **359** using the ⇧**+**, ⇩**-** and ⇧ **NEXT** buttons.
4. The display will show the current syringe set ie. UNIVERSAL, BRAUN PERFUSOR or JANPOL. Use the ⇧**+** and ⇩**-** buttons to select the required set.
5. Turn the keyswitch to **OFF**.

10.0 OPTION KITS

10.1 RS232/Nurse Call Upgrade Option
10.2 B.Braun Perfusor Option Kit
10.3 Janpol Option
10.4 RS232/485 Upgrade Option

10.1 1000PB00053 ISSUE 7

Fitting and Removal Instructions RS232/Nursecall

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 1001PP00003 and relevant component replacement sections as detailed in the service manual, publication numbers 1000PB00048 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 0000JG00004.

1 Introduction

This fitting instruction enables fitting of our RS232 / Nurse Call option allowing the Syringe Pump to communicate via a serial RS232C link with a computer or monitoring system. The nurse call provides a single pole potential free output to an external circuit.

To fit this kit it will be necessary to gain access to the inside of the Syringe Pump.

The Syringe Pump is made up of two case halves, the RS232 / NC option fits to the case lower.

2 Access to the Pump

2.1 Place the unit on a static dissipative surface that is correctly grounded.

2.2 Remove the six case retaining screws (M4 x 45mm pan head) located on the base of the unit and withdraw the base plate.

2.3 Carefully separate the upper and lower case halves and disconnect the grey ribbon cable from the socket on the power supply PCB.

3 Fitting Instructions

3.1 Disconnect the AC mains inlet connector and the DC power ON/OFF switch connector from the power supply PCB. Remove the AC mains inlet from the case by unscrewing the two screws (M3 x 6mm black c'sk) securing the adapter to the case, retain the mains inlet, screws and gasket for refitting.

Remove the DC ON/OFF switch by simultaneously easing the securing tags in and prising the ON/OFF switch out. Retain the switch and splash proof cover for refitting.

Remove the battery connector and the 4 screws (M3 x 20mm pan head) holding the power PCB into the lower case, remove the power supply PCB and retain for refitting.

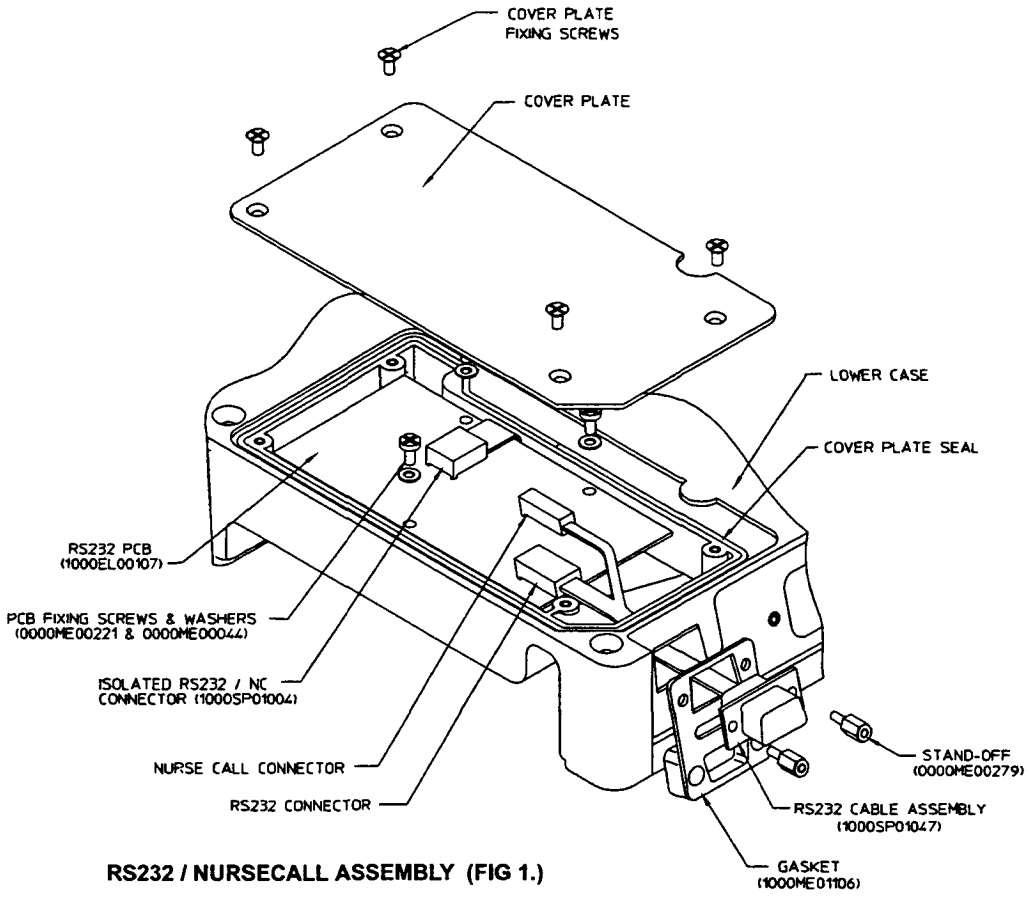
3.2 Carefully peel off the label bonded to the switch panel and clean off any adhesive residue with isopropyl alcohol or a similar non-aggressive solvent. Fit new label (1000LB01015) supplied.

3.3 Remove the four screws (M3 x 6mm black c'sk) securing the cover plate to the underside of the lower case. Carefully hinge the panel open taking care not to damage the base label.

3.4 Fit the RS232 PCB assembly (1000EL00107) using the three M3 x 6mm screws (0000ME00221) and M3 nylon washers (0000ME00044) supplied.

Fit the ribbon cable (1000SP01004) to PL 2 on the RS232 PCB and feed the cable through the slot in case wall adjacent to the power supply PCB area.

10.1 1000PB00053 ISSUE 7 (cont)



RS232 / NURSECALL ASSEMBLY (FIG 1.)

3.5 Assemble the RS232 D type connector (1000SP01047) using the two RS232 threaded stand-offs (0000ME00279). Apply loctite 242 to the two threaded stand-offs before they are fitted. Ensure that the gasket (1000ME01106) is located behind the connector. When RS232 is not in use, the rubber cap in the gasket should be folded down over the connector to prevent fluid ingress through the pins. Fit the 4-way connector to PL 1 and the 2-way connector to PL3 on the RS232 PCB.

3.6 Refit the power supply PCB into the lower case and secure with the four M3 x 20 pan head screws retained from earlier disassembly. Reconnect the AC mains inlet with its gasket and the DC power ON/OFF switch with its splash proof cover, refitting is reverse of removal. Reconnect the AC mains inlet to PL 1, the ON/OFF switch to PL 2 and the battery to PL 3 on the power supply PCB.

Reassemble the two case halves reconnecting the grey ribbon cable to the connector on the power supply PCB. Fit the new RS232 cable to PL 4 on the control PCB.

10.1 1000PB00053 ISSUE 7 (cont)

3.7 Replace the cover plate on underside of the lower case checking that the gasket seal is undamaged and located correctly. Secure the cover plate using the four M3 x 6mm black c'sk screws retained from the earlier disassembly.

3.8 Configure the pump to enable the RS232 option, as described below.

To enable RS232 communications switch the pump on whilst holding down the START button on the front panel. The display will show '- - -'. Use the rate up/down buttons to set the digits to '1 6 7'. Then press the STOP button. The display will show 'C - 0' (RS232 communications disabled). Use the rate button below the '0' digit to change the display to 'C - 1' (RS232 communications enabled). Finally press the STOP button to store the new setting, and switch the pump OFF.

Test the RS232 interface using the free demonstration program (0000TG00015) available from ALARIS MEDICAL SYSTEMS, together with a suitable RS232 cable (9 pin 'D' type connector 1000SP00046).

3.9 Configure the pump to enable the nurse call option as described below.

To enable nurse call communications switch the pump on whilst holding down the START button on the front panel. The display will show '- - -'. Use the rate up/down buttons to set the digits to '1 6 8'. Then press the STOP button. The display will show 'n c 0' (nurse call communications disabled). Use the rate button directly below the '0' digit to change the display to 'n c 1' (nurse call communications enabled). Finally press the STOP button to store the new setting and switch the pump OFF.

Test nurse call is operating by checking that the resistance between pins 6 and 9 on the D type connector goes from open to close circuit when the pump is in alarm condition.

When the nurse call option is enabled more current is consumed during normal operation of the pump as the relay contacts are held open. This means battery life is reduced; it is therefore recommended that the nurse call feature is only enabled if required.

3.10 Carry out self test routine as described in the Directions for Use.

4 Removal Instructions

4.1 Disable RS232 communications 'C - 1' to 'C - 0', as detailed in section 3.8.

Disable Nurse call communications 'n c 1' to 'n c 0', as detailed in section 3.9.

4.2 Obtain access to the pump as detailed in section 2.0.

4.3 Remove the four screws (M3 x 6mm black c'sk) securing the cover plate to the underside of the lower case. Carefully hinge the panel open taking care not to damage the base label.

Disconnect the isolated RS232 / NC ribbon cable from the control panel and remove it from the RS232 PCB. Disconnect the RS232 and nurse call cable from the RS232 PCB. Retain if the option is required in the future.

Remove the four screws securing the PCB and withdraw it from the lower case. Retain PCB and fixings if the option is required in the future.

4.4 Remove the RS232 / nurse call connector, removal is the reverse of fitting see section 3.5. Retain part if the option is required in the future.

4.5 Carefully peel off the label bonded to the switch panel and clean off any adhesive residue with isopropyl alcohol or a similar non-aggressive solvent. Fit a new switch panel label (1000LB01015), the new label will need to be purchased from ALARIS Medical Systems.

4.6 Carry out the self test routine as described in the Directions for Use. Check calibration values and return unit to service.

5 Technical Inquiries.

For additional technical assistance, contact your local ALARIS Service Operations.

Item Number: 5001FAOPT01 OPTION RS232 N/C P5000 Iss: 6

Part Number	Reference	Description	Qty
0000ME00044		WASHER M3 NYLON	3.0
0000ME00221		SCREW M3x6 PAN HD POSI ZP+P	3.0
1000ME01033		SEAL NURSECALL	1.0
1000ME01106		GASKET RS232 MOULDED & CAP A4	1.0
1000SP01025		ASSY NURSECALL CONN V4	1.0
5000EL00022		ASSY PCB ISOLATED RS232/ NC	1.0
5000SP00003		ASSY CONNECTOR RS485	1.0
0000ME00279	215	SCREW MALE/FEMALE M3.4 BRASS AND NICKEL	2.0

10.2 1000PB00006 ISSUE 7

Fitting & Removal Instructions -
1001FAOPT03 -B Braun Perfusor
1001FAOPT04 - Janpol

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after the fitting of any addition/replacement component.

For further information refer to final assembly drawing no. 1000ME00052/1001PP00003/5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 1000PB00048/5000PB00004 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cable Part No. 0000JG00004 (V2/V4) / 5000JG00001 (P5).

1.0 Introduction

This fitting instruction applies to all V2 Syringe Pumps, V4 Syringe Pumps and P5 Syringe Pumps, allowing them to be adapted to USE ONLY 50ml B BRAUN PERFUSOR or 50ml JANPOL SYRINGES.

Units with the build issue 1000ME00052 issue 1 to 27 are fitted with the actuator (1000ME00064) which has its fixing holes vertically opposite. Its B Braun perfusor option equivalent is ALARIS MEDICAL SYSTEMS part no. 1000ME01083.

10.2 1000PB00006 ISSUE 7 (cont)

Units with the build issue 1000ME00052 issue 28 onwards and 1000ME00152/5000ME00020 issue 1 onwards are fitted with the actuator (1000ME00108) which has its fixing holes diagonally opposite. Its B Braun perfusor option equivalent is ALARIS MEDICAL SYSTEMS part no. 1000ME01083.

2.0 Access to the Pump

2.1 Place the unit on a static dissipative surface that is correctly grounded.

2.2 Remove the six case retaining screws (M4 x 45mm pan head) located on the base of the unit and withdraw the base plate.

2.3 Carefully separate the upper and lower case halves and disconnect the grey ribbon cable from the power supply PCB and RS232 / NC cable from the control board PCB if fitted.

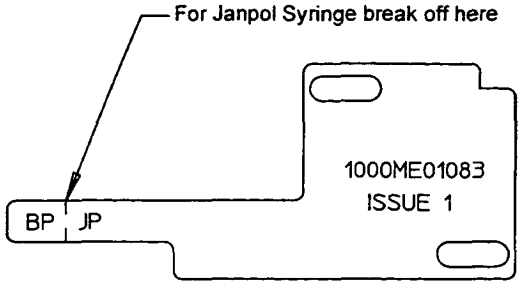
2.4 On reassembly carry out the self test routine as described in the Directions for Use.

3.0 Fitting Instructions

3.1 To replace the actuator (1000ME00108 or 1000ME00064) remove the two screws (No.4 x 3/8") and retain for reassembly. Retain the old actuator (1000ME00108 or 1000ME00064) if you require the use of alternative syringes in future.

Fitting the new actuator (1000ME01083) is the reverse of removal.

If fitting the Janpol syringe option break off the end piece of the actuator as shown below (fig 1.), the rest of the fitting instruction is the same as the B Braun syringe option.

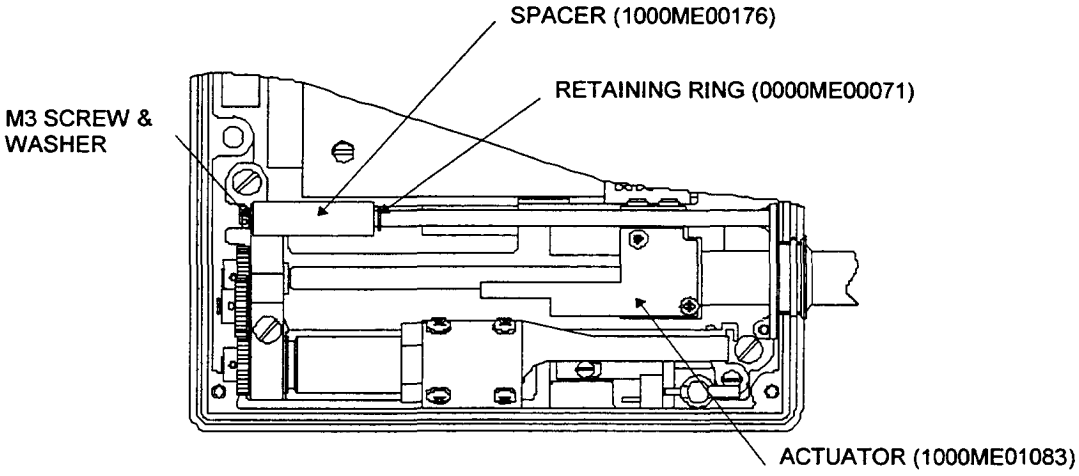


B.BRAUN PERFUSOR or JANPOL 50ml KIT FIG.1.

10.2 1000PB00006 ISSUE 7 (cont)

3.2 To fit the spacer (1000ME00176) remove the torsion rod by undoing the screw (M3 x 6mm pan head) and washer (M3 wavy) securing it to the plate. Retain the fixings for reassembly.
Slide the spacer onto the torsion rod, refit the torsion rod. Fitting is the reverse of removal.
Slide the spacer to the end nearest the motor mounting plate.

3.3 Fit the retaining ring (0000ME00071) by pushing it onto the torsion rod at the point furthest away from the motor mounting plate after the spacer, slide the ring up the torsion rod hard against the spacer to secure it (see fig.2).



B.BRAUN PERFUSOR or JANPOL 50ml KIT FIG.2.

3.4 Reassemble the upper and lower case halves, reconnecting the grey ribbon cable to the power PCB and the RS232 / NC cable to the control PCB if fitted.

3.5 Remove the syringe label type, and replace with the new label (1000LB00099 B Braun or 1000LB00076 Janpol) supplied, V4/V2 units only.

3.6 Reconfigure the pump to "Sy3" and default the syringe size to d50 (50ml syringes only) as detailed in the technical service manual, section 9.1. Carry out the operational and alarm tests.

4.0 Removal Instructions

This part of the fitting instruction applies to the return of standard syringe N.E.O.I options. Protect plunger holder and leadscrew, take precautions to protect the static sensitive components as outlined earlier in this instruction.

10.2 1000PB00006 ISSUE 7 (cont)

4.1 To replace the actuator (1000ME01083) remove the two screws (No.4 x 3/8") and retain for reassembly. Retain the old actuator (1000ME01083) if the B Braun perfusor 50ml syringe option is required in the future. Refit the actuator (1000ME00108 or 1000ME00064) retained from earlier fitting (see section 3.1). If the actuator is damaged or lost a new part can be ordered from IVAC MEDICAL SYSTEMS, part number 1000ME00064 or 1000ME00108.

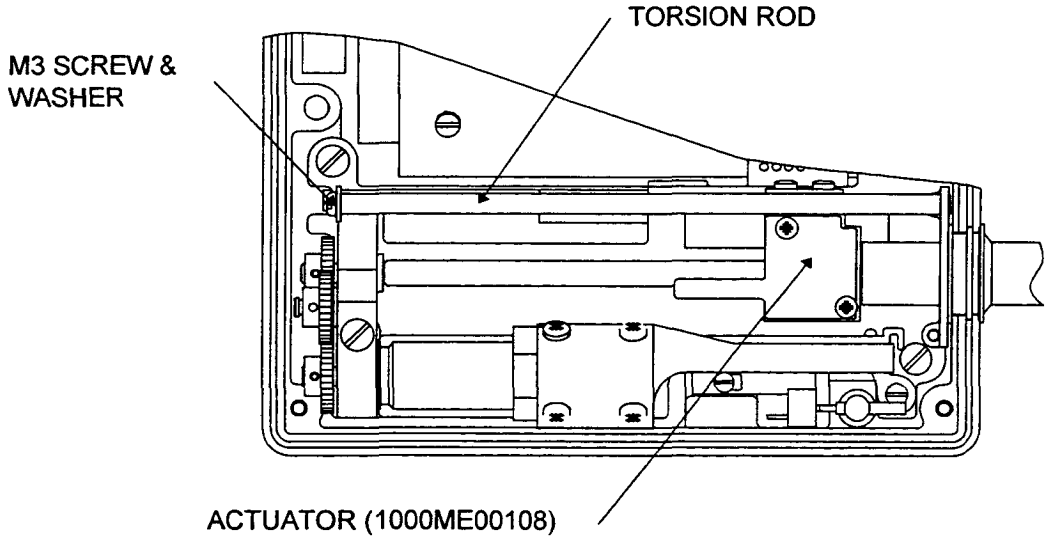
Fitting the actuator (1000ME00064 or 1000ME00108) is the reverse of removal.

4.2 To remove the spacer (1000ME00176) and retaining ring (0000ME00071) it will be necessary to remove the torsion rod. Undo the screw (M3 x 6mm) and washer (M3 wavy) securing the torsion rod to the plate. Retain the parts for reassembly.

Slide the spacer off the torsion rod and retain if the B Braun perfusor or Janpol option is required in the future.

Slide the retaining ring off torsion rod and retain if the B Braun perfusor or Janpol option is required in the future.

Refitting the torsion rod is the reverse of removal, see figure 3.



STANDARD SYRINGE SIZE OPTION LAYOUT **FIG.3**

4.3 Reassemble the upper and lower case halves reconnecting the grey ribbon cable to the power supply PCB and RS232 / NC cable to the control PCB if fitted.

10.2 1000PB00006 ISSUE 7 (cont)

4.4 Remove the syringe label type and replace with the appropriate label supplied with the pump. To order a replacement label set see the spares listings in the technical service manual.

4.5 Reconfigure the pump to the appropriate syringe type setting "SYX" as detailed in the technical service manual, section 9.1. Carry out the operational and alarm tests.

5.0 Technical Inquiries.

For additional technical assistance, contact your local ALARIS Service Operations.

Item Number: 5001FAOPT03 OPTION BRAUN PERFUSOR P5 Iss: 1

Part Number	Description	Qty
0000ME00071	RING SELF LOCK SHFT OD5 1.0	
1000ME00176	SPACER NEOI PERFUSOR/JANPOL	1.0
1000ME01083	ACTUATOR NEOI BRAUN/JANPOL	1.0
1000PB00006	FIT INSTR B.BRAUN/JANPOL	1.0

10.3 5001FAOPT04 ISSUE 1

13.8.3 *Bill of Materials Print ALARIS MEDICAL SYSTEMS

Item Number: 5001FAOPT04 OPTION JANPOL P5 Iss: 1

Part Number	Ref.	Description	Qty
0000ME00071	1	RING SELF LOCK SHFT OD5	1.0
1000ME00176	3	SPACER NEOI PERFUSOR/JANPOL	1.0
1000ME01083	4	ACTUATOR NEOI BRAUN/JANPOL	1.0
1000PB00006	5	FIT INSTR B.BRAUN/JANPOL	1.0

10.4 5001FAOPT06 ISSUE 4

13.8.3 *Bill of Materials Print ALARIS MEDICAL SYSTEMS

Item Number: 5001FAOPT06 OPTION RS232/RS485/NC Iss: 6

Part Number	Reference	Description	Qty
0000ME00044		WASHER M3 NYLON	3.0
0000ME00221		SCREW M3x6 PAN HD POSI ZP+P	3.0
1000ME01033		SEAL NURSECALL	1.0
1000ME01106		GASKET RS232 MOULDED & CAP A4	1.0
1000SP01025		ASSY NURSECALL CONN V4	1.0
5000EL00028		ASSY PCB ISOLATED RS232/ RS485	1.0
5000LB00003		LABEL AC+RS232+RS485/NC	1.0
5000LB00018		LABEL RS485 P5000	1.0
5000SP00003		ASSY CONNECTOR RS485	1.0
0000ME00279	215	SCREW MALE/FEMALE M3.4 BRASS AND NICKEL	2.0

11.0 SUMMARY OF ENGINEERING ACCESS CODES AND ERROR CODES

The **USER DEFINED OPTIONS** and **ENGINEERING CALIBRATION MODES** available on the **IVAC PCAM** are selected by entering the following sequence of control button presses:-

1. Switch the front panel keyswitch to the power **OFF** position.
2. Hold down **START** button and switch the keyswitch to the **SET** position.
3. Wait until the display shows **Access code: - - -**, then release the START button.
4. Use the arrow buttons to enter the first digit of the appropriate **Access code**.
5. Press **NEXT** to select the next digit and repeat step 4.
6. Once the access code is set press **NEXT** to enter the code.
7. Follow the instructions on the display to set and select from the PCAM options.
8. Switch the keyswitch to the power **OFF** position.

The codes summary provided on the following page is for guidance only.

Please refer to the appropriate section of the Technical Service Manual for details of the access modes available.

Please ensure that you are fully familiar with the operation and performance of the unit prior to attempting any calibration or change in its defaults.

IVAC can accept no liability for unauthorised or misuse of the access codes and their subsequent impact on the unit and its performance.

ACCESS CODE	TITLE	DESCRIPTION
123	SELF TEST 1	Self test begins from the start
124	SELF TEST 2	Self test begins at Vin measurement
125	SELF TEST 3	Self test begins at display test
126	SELF TEST 4	Self test begins at declutch test
127	SELF TEST 5	Self test begins at handswitch test
167	COMMS LEARN MODE	Configuration set via comms interface
168	COMMS TEACH MODE	Configuration output to another device

11.1 ACCESS CODES (continued)

243	SYRINGE SIZE CALIBRATION	Syringe size measurement calibration
251	CONFIGURATION MENU	Configure options, protocols, drug limits and real time clock
359	BUILD CONFIGURATION	Configure language, syringe range, comms interface type
376	SERVICE LOG	Review service log, errors and time in use
501 **502**	MASS AND VOLUME DOSING	501 - Enables Mass dosing 502 - Enables Volume dosing
611	TOTAL MEMORY CLEAR	Reset memory - will require full calibration
717	OCCLUSION CALIBRATION	Occlusion measurement calibration
794	ACCESS FULL EVENT LOG	Access to patient history.
835	MODIFY CLINICIAN CODE	Modify the 3 digit clinician override code
999	LOAD DEMO. GRAPHS	Load demonstration data into history graphs

11.2 ERRORS CODES

Code	Malfunction	Description
1	Grid speed	Motor speed too slow
2	Grid speed	Motor speed too fast
3	Motor control	Too many motor encoders
4	Motor control	Too few or no motor encoders
5	Ram	Memory contents checks reveal a discrepancy
6	Watchdog	Watchdog timer too slow during power up test
7	Watchdog	Watchdog timer too fast during power up test
8	Cover detect	Reed switch closed when drive is disengaged
9	Motor control	Possible incorrect motor wiring
10	VREF	Analogue to digital converter voltage reference out of range
11	Beam	Occlusion measurement beam - strain gauge current fault
12	Amp	Occlusion measurement beam amplifier gain fault
13	Motor on failed	Motor off should be on during power up motor control test
14	Motor off failed	Motor on should be off during power up motor control test
15	Watchdog	Watchdog fail - watchdog timer failed during normal operation
16	Plunger stuck	Plunger stuck - button in with no syringe size during power up test
17	Hardware	Display drive electronics fault
18	Soft fault	Error detected in software operation
19	-	-
20	Handswitch	Short circuit in handswitch cable connections
21	CRC	Program memory cyclic redundancy code check failed
22	Stack	Software stack overflow detected
23	Opto	Suspected failure of grid, near end or plunger opto
24	Hardware	Battery volts out of range suspect measurement electronics fault
25	Hardware	Video RAM check error suspect display fault
26	Switch	Switch Stuck in failure.
32	Software Flow Control	Internal program disrupted
33	RAM	Non-volatile RAM contents corrupted
34	Soft Fault	Software has an illegal operation
35	Microcontroller	Performs an unknown operation
36	Address Error	Access a word on an odd address boundary
37	Soft Fault	Non-maskable interrupt has been requested
38	Trap Function	Internal trap interrupt has occurred

12.0 SPARE PARTS LISTING

Item Number: 5000PB00016 SPARES LISTING (P5) Iss: 3

Part Number	Description
0000EL00004	BATTERY 6V NP2.8-6 RECHARGE
0000EL00095	CLIP CABLE SELF ADHESIVE
0000EL00100	CABLE BLACK 7/0.2
0000EL00101	CABLE RED 7/0.2
0000EL00653	TIE CABLE PCAM HANDSET
0000ME00001	BEARING OD 8.0 ID3.0 L4.0
0000ME00002	CIRCLIP E TYPE SHAFT DIA 4.8
0000ME00003	SPRING COMP OD 6.1 19 LONG
0000ME00004	SCREW M3x6 PAN HD Z+C
0000ME00005	SCREW M3x6 CSK HD SLOTTED ZINC
0000ME00009	SCREW M3x5 CSK SET CUP
0000ME00010	SCREW M3x10 PAN HD SLOTTED
0000ME00011	SCREW No4x1/4" PAN HD
0000ME00014	NUT M3 Z + C
0000ME00015	WASHER M3 WAVEY SST
0000ME00016	PIN TENSION DIA 2.0x10mm
0000ME00018	PIN TENSION DIA 2.0x20mm
0000ME00023	GEAR SPUR 0.5M 35T PA 20 DEG P1000/2000/3000
0000ME00026	FOOT SELF ADHESIVE V4
0000ME00027	WASHER M5 PLAIN Z+C
0000ME00030	SCREW M3x8 SKT SET FULL
0000ME00031	SCREW No4x3/8" PAN HD
0000ME00032	SCREW No4x1/2" PAN HD
0000ME00035	SCREW M4x45 PAN HD SLOTTED
0000ME00036	SCREW M4x40 PAN HD SLOTTED
0000ME00038	SCREW M4x20 CSK HD SLOTTED
0000ME00044	WASHER M3 NYLON
0000ME00045	WASHER M4 WAVEY SST
0000ME00048	WASHER M3 PLAIN Z+C
0000ME00049	KNOB DIA 35mm INSERT M8
0000ME00084	SCREW M2x12 CSK HD SLOTTED
0000ME00102	DISC DOUBLE SIDED TAPE
0000ME00108	SCREW M4x16 PAN HD SLOTTED
0000ME00110	SPRING COMP OD 7.62 44 LONG
0000ME00112	CIRCLIP
0000ME00116	PIN TENSION DIA 3.0x16mm
0000ME00132	PIN TENSION DIA 1.5 x 10mm
0000ME00133	SPRING COMPRESSION 2.24 DIA x 7.9mm
0000ME00134	SPRING COMPRESSION 5.33 DIA x 7.9mm

Item Number: 5000PB00016 SPARES LISTING (P5) Iss: 3

Part Number	Description
0000ME00136	O RING 13.0 I/D x 1.5
0000ME00141	STUD PE CONNECTOR M6 THREAD
0000ME00142	PIN TENSION DIA 2.0 x 5.0mm
0000ME00146	SCREW M3x8 SKT SET PART
0000ME00156	COVER MAGNET LATCH
0000ME00157	SCREW M4x12 CSK SNAKE EYE
0000ME00160	O RING 3.0 I/D x 1.5
0000ME00161	O RING 4.47 I/D x 1.78
0000ME00162	O RING 19.0 I/D x 1.5
0000ME00163	CIRCLIP E TYPE DIN 6799
0000ME00164	SCREW M2x3 CSK HD SLOTTED
0000ME00166	SCREW M3x6 SNAKE EYE
0000ME00169	SPRING EXTENSION
0000ME00170	SPRING EXTENSION
0000ME00183	SPRING COMPRESSION
0000ME00185	O RING 6.1 I/D x 1.6
0000ME00186	WASHER 13.5 X 9.61 X 0.5 NYLON
0000ME00187	WASHER KEYSWITCH SEALING
0000ME00188	WASHER 18.35 X 15.91 X 0 .75 NYLON
0000ME00189	SCREW M3x12 POZI HD Z+C
0000ME00221	SCREW M3x6 PAN HD POSI ZP+P
0000ME00222	SCREW M3x6 CSK HD POSI 1 Z+BLACK
0000ME00223	SCREW M3x10 PAN HD POSI ZP+P
0000ME00224	SCREW M4x45 PAN HD POSI ZP+P
0000ME00225	SCREW M4x40 PAN HD POSI 2 ZP+P
0000ME00226	SCREW M4x20 CSK HD POSI 2 ZP+P
0000ME00227	SCREW M4x16 PAN HD POSI 2 ZP+P
0000ME00228	SCREW M3x20 PAN HD POSI 1 ZP+P
0000ME00229	SCREW M4x10 PAN HD POSI 2
0000ME00230	SCREW M3x8 CSK HD POSI Z+BLACK
0000ME00231	SCREW M3x8 PAN HD POSI ZP+P
0000ME00246	SCREW M4x8 PAN HD POSI
0000ME00251	KNOB/STUB POLE CLAMP
0000ME00257	PIN TENSION 3.0x1
0000ME00266	SPRING 7.8 OD 44 LONG
0000TG00020	TEST GEAR OCCLUSION HIGH ACCURACY
1000LB00001	LABEL BATTERY TYPE
1000LB01005	LABEL BASE PANEL V4
1000LB01006	LABEL BASE ALARM VOLUME
1000ME00010	SPIGOT IDLER
1000ME00040	GEAR MACHINED 35 TOOTH P1000,2000,3000
1000ME00048	PLATE TORSION MOTOR END
1000ME00076	SPACER TRANSMISSION 5.25 LONG

Item Number: 5000PB00016 SPARES LISTING (P5) Iss: 3

Part Number	Description
1000ME00093	PLATE POT. S.S. V4
1000ME00097	HALFNUT V4
1000ME00114	BUSH LEADSCREW
1000ME00169	STUD POLE CLAMP 40mm
1000ME00170	PAD POLE CLAMP 40mm
1000ME00174	ENCODER MOTOR
1000ME00175	ACTUATOR POT. MOULDED
1000ME00192	KNOB/STUD MACHINED
1000ME01004	PLATE BAT RESTRAINT V4
1000ME01006	CLAMP SYRINGE MACH. V4
1000ME01011	LEADSCREW V4
1000ME01012	PLATE MOTOR MTG V4 P1000 /2000/3000
1000ME01013	CARRIAGE V4
1000ME01015	ROD TORSION
1000ME01018	LEVER DECLUTCH V4
1000ME01019	TUBE INTERMEDIATE ASSY
1000ME01021	PLATE CHASSIS V4
1000ME01022	PLATE OUTER TUBE SEAL V4
1000ME01025	BUTTON PLUNGER HOLDER
1000ME01026	HOLDER PLUNGER CRUCIFORM
1000ME01027	PIN PLUNGER PLATE
1000ME01028	GASKET INTERMEDIATE TUBE
1000ME01035	GRID LINEAR 1.5 PITCH V4
1000ME01036	CLAMP MACHINED
1000ME01037	SEAL OUTER TUBE
1000ME01047	SEAL RING OUTER TUBE
1000ME01048	SEAL RING LEADSCREW
1000ME01051	ALARM TUBE V4
1000ME01056	PLATE PLUNGER RESTRAINT
1000ME01059	HOLDER PLUNGER V4
1000ME01060	HOLDER BACKPLATE PLUNGER
1000ME01061	GASKET PLUNGER HOLDER V4
1000ME01064	FOAM PAD BATTERY
1000ME01066	FOAM PAD CHASSIS PLATE
1000ME01069	MOUNT OPTO MOULDED V4
1000ME01074	GASKET MAINS INLET V4
1000ME01081	SEAL LEADSCREW
1000ME01088	TUBE OUTER POLISHED 5/8"
1000ME01090	CORD SILICON, D SHAPED INTERNAL EXTRUSION
1000SP00009	ASSY CABLE BATTERY
1000SP01001	ASSY INLET MAINS CONN
1000SP01005	ASSY ALARM AUDIBLE
1000SP01006	ASSY CIR FLEXI NO.1

Item Number: 5000PB00016 SPARES LISTING (P5) Iss: 3

Part Number	Description
1000SP01007	ASSY CIR FLEXI NO.2
1000SP01017	ASSY POTENTIOMETER 50K
1000SP01022	ASSY MICROSWITCH V4
1001FAOPT91	OPTION CORD POWER R/A GB MOULDED
1001FAOPT92	OPTION CORD POWER EUROPE AN
1001FAOPT93	OPTION CORD POWER 2M R/A UNTERMINATED
1001FAOPT94	OPTION CORD POWER 2M R/A CSA APPROVED
5000EL00037	ASSY PCB DISPLAY P5000
5000EL00038	ASSY PCB PSU 240V P5000
5000EL00039	ASSY PCB PSU 110V
5000EL00055	ASSY PCB CONTROL PCAM
5000EL00065	ASSY PCB CONTROL P5000
5000LB00002	LABEL GB FP P5000 ENGLISH
5000LB00005	LABEL FR FP P5000 FRENCH
5000LB00006	LABEL DD FP P5000 GERMAN
5000LB00008	LABEL GB INSTR P5000 ENGLISH
5000LB00010	LABEL PCAM LOGO
5000LB00014	LABEL KEY OPERATION
5000LB00016	LABEL BLANKING
5000ME00007	PLATE BASE RS232 PCAM
5000ME00008	WINDOW DISPLAY
5000ME00012	PLATE LOCK CAM
5000ME00014	SHAFT SYRINGE CLAMP
5000ME00021	SPACER BUTTON FRONT PNL
5000ME00031	LATCH CAM
5000ME00034	SLEEVE COVER HINGE
5000ME00035	LATCH
5000ME00036	RESTRAINT MAGNET
5000ME00040	LOCK SEAL BODY
5000ME00041	SPINDLE LOCK SEAL
5000ME00051	NUT LOCK SEALING
5000ME00052	ARM SPRING
5000ME00053	PLATE SPRING
5000ME00054	SPEC KEYSWITCH
5000ME00055	SPEC MECHANICAL LOCK
5000ME00062	COVER 50ml MACH. DETAIL
5000ME00064	COVER 100ml MECH. DETAIL
5000ME00066	LABEL COVER SPRING ARM BUFFER
5000ME00071	BODY SPRING MECHANISM
5000ME00073	BUSH COVER HINGE P5000
5000ME00074	ROD SUPPORT
5000ME00078	SHAFT SYRINGE CLAMP P500 0
5000ME00081	WASHER KEYSWITCH SEALING
5000ME00082	SPACER COVER 100ml MAGNE T HOLDER

Item Number: 5000PB00016 SPARES LISTING (P5) Iss: 3

Part Number	Description
5000ME00083	SPACER COVER 100ml LATCH
5000SP00001	ASSY KEYSWITCH
5000SP00002	ASSY HANDSET CONNECTOR
5000SP00010	SPARE KEY ELEC/MECH P5000
5000SP00020	SPARE TRANSMISSION P5000
5000SP00029	SPARE UPGRADE P5000
5001FAOPT01	OPTION RS232 N/C P5000
5001FAOPT06	OPTION RS232/RS485/NC
5001FAOPT71	OPTION DFU GB P5000 ENGLISH
5001FAOPT72	OPTION DFU DD P5000 GERMAN
5001FAOPT73	OPTION DFU FR P5000 FRENCH

13.0 TECHNICAL INFORMATION BULLETINS

13.1 0000TB00013 - Technical Bulletin Reset Resistor Pull-up P5 Control Board.
13.2 0000TB00023 - Software Upgrade for Pcam (Software V2R5).
13.3 0000TB00025 - Recommended Upgrade Handset Connector Assembly.
13.4 5000PB00012 - Spares Upgrade Clock Accuracy Modification.
13.5 5000PB00013 - Spares Upgrade Cover Spring Mechanism.
13.6 5000PB00014 - Spares Upgrade Display Temperature Compensation Modification.
13.7 5000PB00015 - Spares Upgrade Backlight Ground Connection Modification.
13.8 5000PB00017 - Spares Upgrade Control PCB P5000.
13.9 5000PB00026 - Spares Upgrade Cases P5000.
13.10 5000PB00029 - Fitting Instructions Keyswitch Upgrade P5000.
13.11 0000TB00032 - Technical Bulletin V2R6 Software.
13.12 0000TB00038 - Alternative Routing for P1-3 & P5 Flexible Circuit.
13.13 0000TB00041 - Flexible Circuit Added to Beam Assembly.
13.14 0000TB00043 - Pcam Loading Dose Clarification.
13.15 0000TB00054 - Revised Syringe Size Calibration P5000.
13.16 0000TB00056 - Fluid Sealing Enhancements.
13.17 0000TB00057 - Recommendation of DC/AC Inverter.
13.18 0000TB00058 - Technical Bulletin Syringe Plunger Detect Problems.
13.19 0000TB00059 - Technical Bulletin Transmission Tight when Declutched.

13.1 0000TB00013 ISSUE 4

Technical Bulletin Reset Resistor Pull - Up
P5000 Control Board

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.
For further information refer to final assembly drawing no. 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 5000PB00004 when following this instruction.
Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 5000JG00001.

1.0 Introduction

The reset circuit of the PCAM Control board controls the power up sequence of the hardware. The circuit operates to activate the reset - the MAX 691 pulls down the reset line for a short time after power up and then releases it. The released pull up was a weak current inside the MAX 691; so a 10K resistor has been added to increase the pull up current. This will make the control board less susceptible to false reset, which may have occurred under severe external interference conditions.

This Technical Bulletin applies to units with serial numbers:
5001-00001 to 5001-01620

2.0 Access to the Pump

2.1 Place the unit on a static dissipative surface that is correctly grounded.
2.2 Remove the six case retaining screws (M4 x 45mm pan head) located on the base of the unit and withdraw the base plate.
2.3 Carefully separate the upper and lower case halves and disconnect the grey ribbon cable from the socket on the power supply PCB.

3.0 Fitting Instructions

3.1 Fit the 10K resistor 0000EL00042 as shown in figure 1. Fit the resistor between pin 3 and 10 taking care not to short circuit to any other pins when soldering the resistor in place. Ensure that the sleeving 0000EL00451 is fitted to prevent the possibility of sorting.

3.2 Remove the M4 x 10 pan head screw and M4 wavy washer which secures the earth tag. Solder the joint between the earth tag and the earth wire J8 on the control board, see figure 2. This will ensure that the joint is secure.
3.3 Ensure that the backlight cable is routed behind the fixing post, as shown in figure 1.

Figure 1.

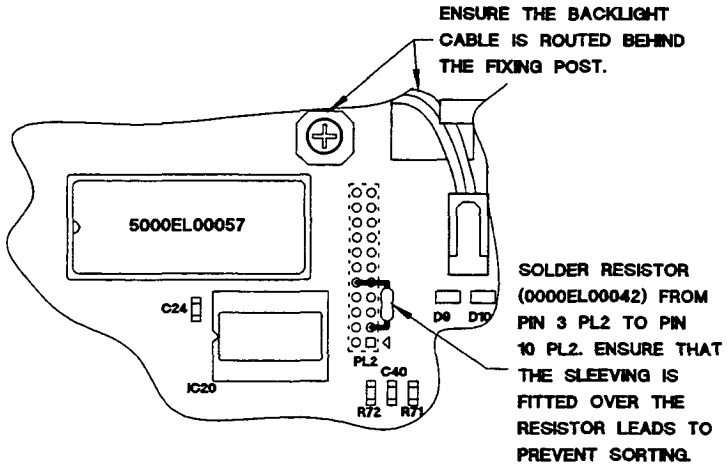
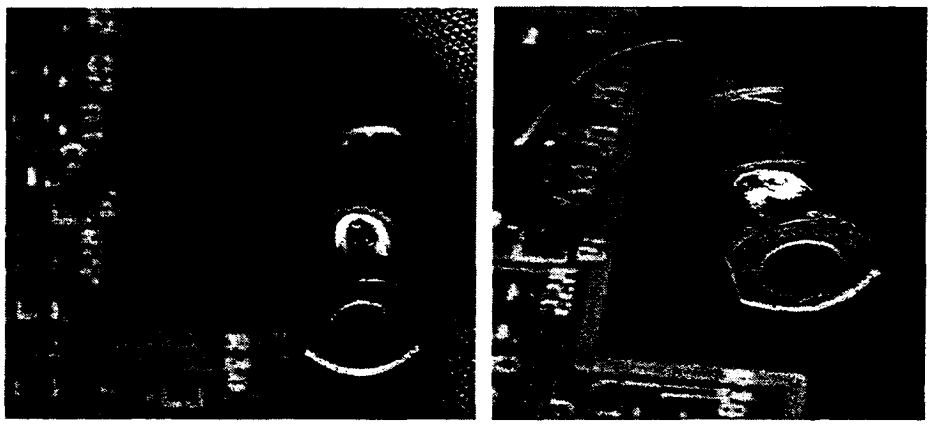


Fig 2.



Screw the tag firmly back in place with the wavy washer under the screw head.

3.4 Add the letters 'RR2' to the build issue label situated in the lower case assembly. This shows that the Reset Resistor Modification has been carried out.

3.5 Reconnect any ribbon cables connected between the control board and the power supply board.

3.6 Reassemble the unit and secure the cases using the six case retaining screws removed earlier.

3.7 Complete the self test routine as described in the technical service manual.

4.0 Technical Inquiries.

For additional technical assistance, contact your local ALARIS Service Operations.

13.2 0000TB00023 ISSUE 1

Software Upgrade for PCAM
(Software V2R5)

This software upgrade can be fitted to all PCAM units.

1.0 Description

The software for the PCAM pump has been upgraded to incorporate the following customer requests.

1.1 Max. dose log anomaly in volume mode.

An irregularity in the maximum dose log feature meant that in the volume programming mode the software was measuring a dose as a volume limit and not as a rolling log. The effect was that after a period of time the software could alarm 'max dose exceeded' when in fact the dose inside the limit period (eg 4 hours) was not exceeded, given that doses from over 4 hours previous should have been removed from the calculation.

1.2 False syringe alarms

Some false syringe alarms had been reported from the field and noted that a change in dimensions between production of the hard tool and soft tool cases meant that syringes were normally at the top of the recognition band. This meant that if the syringe clamp was not pushed down a false alarm could occur. This correction does not widen the recognition band but allows the software to work with both soft tool and hard tool cases.

2.0 Technical Inquiries

For further assistance, contact your local ALARIS service operator.

13.3 0000TB00025 ISSUE 3

Recommended Upgrade Handset Connector Assembly

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 5000PB00004 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

Always protect the plunger holder, cover and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. For regular servicing we recommend the use of the upper case support cradle Part No. 5000JG00001. This will avoid damaging the mechanism or the cover.

1.0 Introduction

This upgrade can be fitted to the following units:
Serial Numbers: 5001 - 1043 to 5001 - 1427

This fitting instruction refers to the spares kit 5000SP00036.

This fitting instruction applies to P5000 units with build issues of 46 and below.

Note: This upgrade does not have to be performed if the unit has already had the 'HS' upgrade fitted.

2.0 Access to the Pump

2.1 Place the unit on a static dissipative surface that is correctly grounded.

2.2 Remove the six case retaining screws (M4 x 45mm pan head) located on the base of the unit

2.3 Carefully separate the upper and lower case halves and disconnect the cable assemblies between the power supply board and the control board assembly.
Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

3.0 Fitting Instructions

3.1 Disconnect the handset inlet connector from the power supply board.

3.2 Remove the fixing screw 0000ME00011 which retains the handset ground braid.

3.3 Remove the nut from the back of the handset inlet assembly 5000SP00027 and remove the assembly from the lower case.

3.4 Fit the star washer 0000ME00260 (supplied), the handset earth tag and secure the whole assembly with the nut ensuring that the red dot faces to the right, apply loctite 242 or equivalent to the lock nut before assembly. See figure 1 for further information.

Note: Do not use the handset connector assembly for 24 hours after the loctite has been applied in order for it to set.

3.5 Secure the earth tag connector to the lower case using the fixing screw 0000ME00011 retained from earlier.

3.6 Connect the handset inlet connector to the power supply board.

3.7 Add the letters 'HA' to the build issue label in the lower case.

3.8 Connect the cable assemblies between the power supply board and the control board.

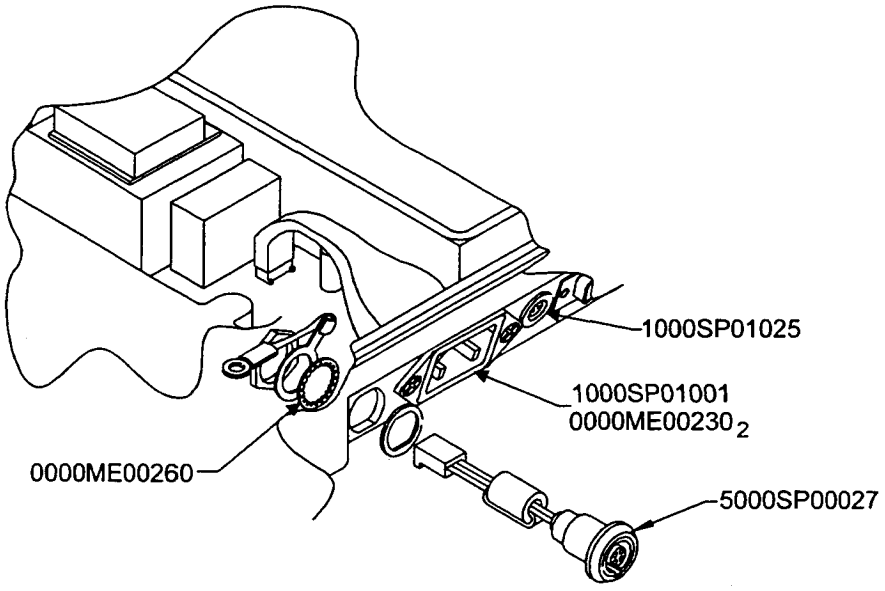
3.9 Fit the upper case to the lower case and secure using the six case retaining screws kept from earlier.

3.10 Fit the handset assembly 5000SP00026 into the handset inlet connector assembly and ensure that the handset operates correctly.

3.11 Complete a self test routine on the unit, as described in the technical service manual.

13.3 0000TB00025 ISSUE 3 (CONT)

Figure 1



4.0 Technical Inquiries.

For additional technical assistance, contact your local ALARIS Service Operations.

13.4 5000PB00012 ISSUE 2

Spares Upgrade Clock Accuracy Modification

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 5000PB00001 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

1.0 Introduction

This fitting instruction applies only to pumps with serial numbers 5001-00050 to 5001-00368

The real time clock appears to run slowly on some PCAM devices, typically it has been shown to run about 0.04% slow, resulting in the clock loosing several minutes in a week.

This accuracy is improved to +/- 0.002% by implementing the modification described in this publication.

2.0 Access to the Pump

2.1 Place the unit on a static dissipate surface which has been correctly grounded.

2.2 Remove the six case retaining screws (M4 x 45mm pan head) located on the base of the unit.

2.3 Carefully separate the upper and lower case halves and disconnect the ribbon cables from the sockets on the power supply and RS232/RS485 ribbon cable.

13.4 5000PB00012 ISSUE 2 (cont)

3.0 Fitting Instructions

3.1 For further information refer to the final assembly drawing 5000PP00001.

3.2 Cut the track between C22 and IC13 on the control board with a sharp knife, see figure 1. Check that the top C22 contact is now open circuit from IC15 pin 20.

3.3 Wire a link from the top of C22 to IC13 pin 8. This connects C22 as a supply decoupling capacitor across the power pins of IC13.

3.4 Add a capacitor 22pF ceramic disc 0000EL00108, prebend the leads as shown, see figure 2, and solder it to pins 1 and 8 of IC13. This slows the clock oscillator to improve the long term clock accuracy.

3.5 Add the letters 'CA' to the PCAM build status label to show that the clock accuracy modification has been performed.

3.6 Reconnect the ribbon cables between the power board and the control board and the RS232 board and the control board.

3.7 Reassemble the two case halves and refit the six case retaining screws.

3.8 Perform the self test routine as described in the service manual.

3.9 The unit can now be returned into service.

Fig. 1

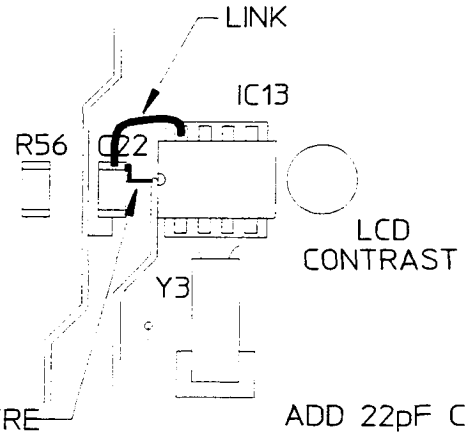
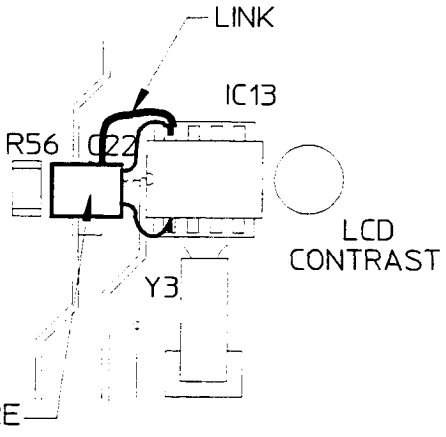


Fig. 2



4.0 Technical Inquiries.

For additional technical assistance, contact your local ALARIS Service Operations.

13.5 5000PB00013 ISSUE 2

Spares Upgrade Cover Spring Mechanism

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 5000PB00001 when following this instruction.

1.0 Introduction

This fitting instruction applied to all P5 pumps build prior to build issue 10.

The cover spring mechanism 5000ME00037 has been superseded by cover spring mechanism 5000ME00071.

The upgrade has been introduced to increase the throw of the cover.

2.0 Fitting Instructions

2.1 For further information refer to the final assembly drawing 5000PP00001.

2.2 Open the cover to expose the spring mechanism.

2.3 Remove the blanking label 5000LB00016 to expose the spring mechanism fixing screws.

2.4 Remove the M3 x 6 snake eye fixing screws 0000ME00166 2 off and remove the spring mechanism.

2.5 Remove the compression spring 0000ME00165 from the spring mechanism assembly.

2.6 Remove the spring mechanism arm from the assembly 5000ME00052. Refit the spring mechanism arm into the replacement spring mechanism body 5000ME00071.

2.7 Fit the replacement compression spring 0000ME00183 into the spring mechanism body 5000ME00071.

13.5 5000PB00013 ISSUE 2 (cont)

2.8 Fit the spring mechanism to the cover and refit the M3 x 6 snake eye screws 0000ME00166 2 off.
2.9 Fit the replacement blanking label.
2.10 Test that the cover lock is operating correctly.
2.11 The unit can now be returned into service.

3.0 Technical Inquiries.

For additional technical assistance, contact your local ALARIS Service Operations.

13.6 5000PB00014 ISSUE 2

Spare Upgrade Display Temperature Compensation Modification

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 5000PB00004 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

1.0 Introduction

This fitting instruction applies only to units with the serial numbers 5001-00050 to 5001-00376

Variation in the operating temperatures of the PCAM, as well as the warming affect of the backlight lamp results in the contrast of the display varying.

The effect of the temperature variation is compensated by the addition of a thermistor.

This fitting instruction applies to the spares upgrade kit 5000SP00022.

2.0 Access to the Pump

2.1 Place the unit on a static dissipate surface which has been correctly grounded.

2.2 Remove the six case retaining screws (M4 x 45mm pan head) located on the base of the unit.

2.3 Carefully separate the upper and lower case halves and disconnect the ribbon cables from the sockets on the power supply and disconnect the RS232/RS485 ribbon cable.

13.6 5000PB00014 ISSUE 2 (cont)

3.0 Fitting Instructions

3.1 Cut the track shown and fit the thermistor (part no. 0000EL00328) as shown in fig 1, on the component side of the display board.

3.2 Record the modification completion by adding the letters 'CM' (Compensation Modification) on the build status label inside pump.

3.3 Refit the power board ribbon cable and the RS232/RS485 cable (if fitted).

3.4 Refit the six case retaining screws located on the base.

3.5 The unit can now be returned to service.

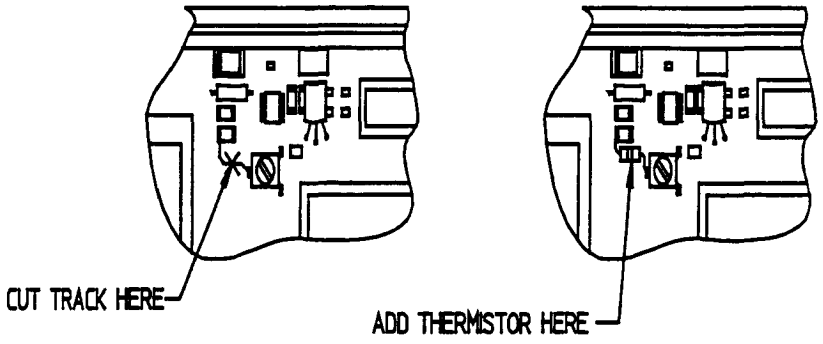


Fig. 1.

4.0 Technical Inquiries.

For additional technical assistance, contact your local ALARIS Service Operations.

13.7 5000PB00015 ISSUE 2

Spares Upgrade Backlight Ground Connection Modification

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 5000PB00004 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

1.0 Introduction

This fitting instruction applies only to units with serial numbers 5001-00050 to 5001-00281

The display backlight shroud earthing passed through the display bezel retaining tags. This contact appeared to be intermittant on occasions and allowed interference from the backlight to affect the watchdog circuit on the control board.

The result was occasionally false alarms 'Error 15' watchdog failure, and power up phase 'Error 6' and 'Error 7'.

2.0 Access to the Pump

2.1 Place the unit on a static dissipate surface which has been correctly grounded.

2.2 Remove the six case retaining screws (M4 x 45mm pan head) located on the base of the unit.

2.3 Carefully separate the upper and lower case halves and disconnect the ribbon cables from the sockets on the power supply and disconnect the RS232/RS485 ribbon cable (if fitted).

13.7 5000PB00015 ISSUE 2 (cont)

3.0 Fitting Instructions

3.1 Fit a wire (insulated 7/0.2 wire 0000EL00100) to the back of the display board as shown in fig 1.

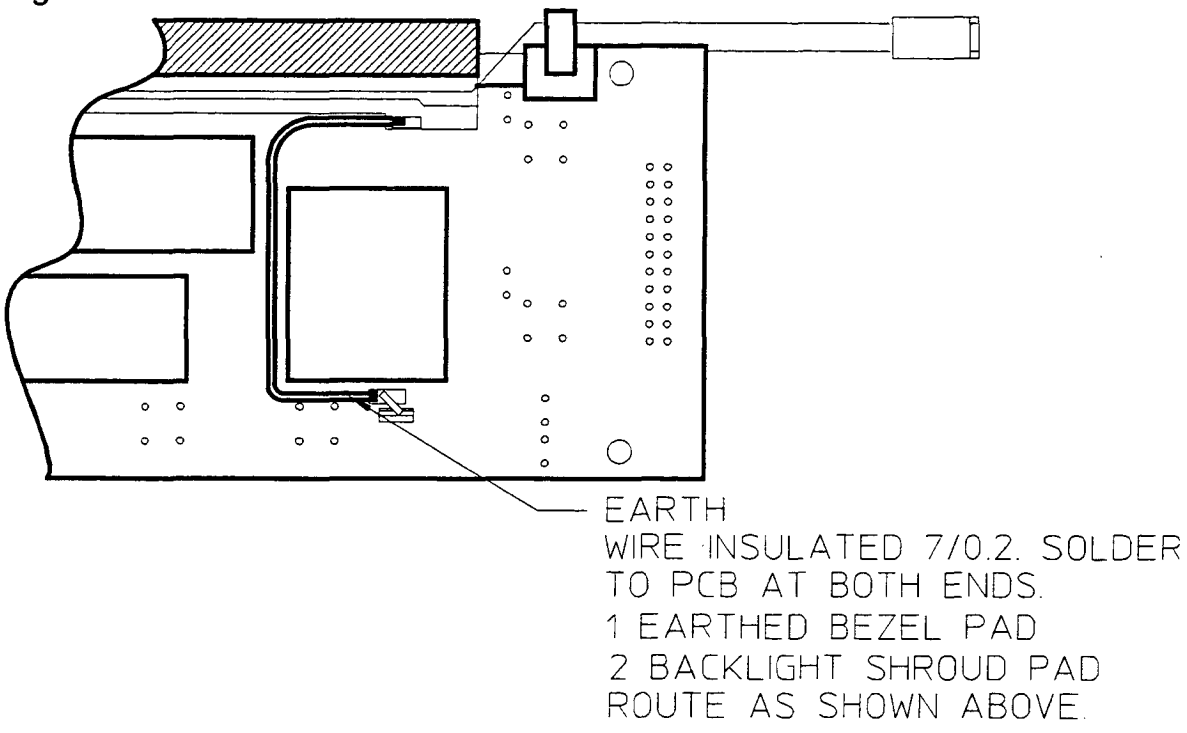
3.2 Record the modification completion by adding the letters 'EW' (Earth Wire) on the build status label inside the pump.

3.3 Refit the power board ribbon cable and the RS232/RS485 ribbon cable (if fitted).

3.4 Refit the six case retaining screws located on the base of the unit.

3.5 The unit can now be returned to service.

Fig. 1.



4.0 Technical Inquiries.

For additional technical assistance, contact your local ALARIS Service Operations.

13.8 5000PB00017 ISSUE 4

Spares Upgrade Control PCB P5000

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 5000PB00004 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cable Part No. 5000JG00001.

1.0 Introduction

The control board on the P5000 (5000EL00055) has been superseded by the P5000 control board 5000EL00065.

A new Control PCB design was introduced to the PCAM product - this included an EPROM for software storage to allow incorporation of German and other language options. Additional software features were also included in Version 2 (and above) software which can be fitted to the new Control PCB. The new Control PCB includes hardware to allow the PCAM display backlight to be switched off. PCAM syringe pumps with serial numbers above the range shown above have the upgraded PCB fitted already.

This fitting instruction applies to the spares kit 5000SP00019.

2.0 Access to the Pump

2.1 Place the unit on a static dissipate surface that is correctly grounded.

2.2 Remove the six case retaining screws (M4 x 45mm pan head) located on the base of the unit and withdraw the base plate.

2.3 Carefully separate the upper and lower case halves and disconnect the grey ribbon cable from the socket on the power supply PCB; and disconnect the key switch cable from the power supply PCB. Also disconnect the interface board connector.

3.0 Fitting Instructions

3.1 The parts supplied in the spares kit **5000SP00019** include a PCB and EPROM (with latest software) which may already be fitted to the PCB.

3.2 Remove the 5 screws securing the control and display PCBs into the upper case. Disconnect the beam, flexible circuit and syringe potentiometer connectors. Remove the boards, disconnect the display lamp connector and separate the PCBs.

Note: If the display board fitted to the unit which is being upgraded is under issue 7, fit the 5 nylon washers 0000ME00044 on top of the spacers and secure the washers to the spacers using cyno-acrylate or equivalent. For display boards over issue 7 this action is not required.

3.3 Replace the control board with the new board 5000EL00065 and reconnect the display lamp connector securing the wires under the retaining section in the PCB profile. Fit the 5 securing screws into the control PCB.

3.4 Replace any front panel buttons onto the display board switch stems; if any have fallen off in the process of disassembly.

3.5 Carefully replace the control and display board assemblies in the upper case (taking care not to dislodge switch buttons). Reconnect the board connectors and screw the PCB assembly into the upper case.

3.6 Amend the build issue label by adding 'CB' to show that the units as been fitted with the control board upgrade.

New PCB Configuration

3.7 After reassembly the new board needs to be configured for use. Follow the instructions in the service manual for a) calibration after replacing internal RAM, b) syringe size calibration, c) and occlusion calibration.

3.8 Finally configure the syringe and language options using access code '359'.

3.9 Perform a full system self test as described in the Technical Service Manual.

4.0 Technical Inquiries.

For additional technical assistance, contact your local ALARIS Service Operations.

13.9 5000PB00026 ISSUE 6

Spares Upgrade Cases P5000

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 5000PB0004 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. For regular servicing we recommend the use of the upper case support cradle Part No. 5000JG00001. This will avoid damaging the cover.

1.0 Introduction

This fitting instruction applies to P5000 units with build issues 46 and below.

This fitting instruction refers to the spares kit 5000SP00029.
This fitting instruction covers the actions required to replace the upper and lower P5000 cases. Access to the upper and lower case assemblies will be required.
The lower case 5000ME00001 has been superseded by 5000ME00067. The upper case 5000ME00002 has been superseded by 5000ME00068. The handset assembly 5000SP00009 has been superseded by 5000SP00026. The power supply 240V 5000EL00038 has been superseded by 5000EL00060. The power supply 110V 5000EL00039 has been superseded by 5000EL00061. The base plate 5000ME00007 has been superseded by 1000ME01005. The RS232 gaskets 1000ME01074 and 1000ME01079 have been superseded by 1000ME01106.

13.9 5000PB00026 ISSUE 6 (cont)

This modification has to be performed as a result of implementing the hard tooled P5000 cases.
In addition to 5000SP00029 the appropriate front panel label will need to be purchased.

2.0 Access to the Pump

2.1 Place the unit on a static dissipative surface that is correctly grounded.
2.2 Remove the six case retaining screws (M4 x 45mm pan head) located on the base of the unit .
2.3 Carefully separate the upper and lower case halves and disconnect the cable assemblies between the power supply board and the control board assembly.

3.0 Fitting & Removal Instructions Upper Case

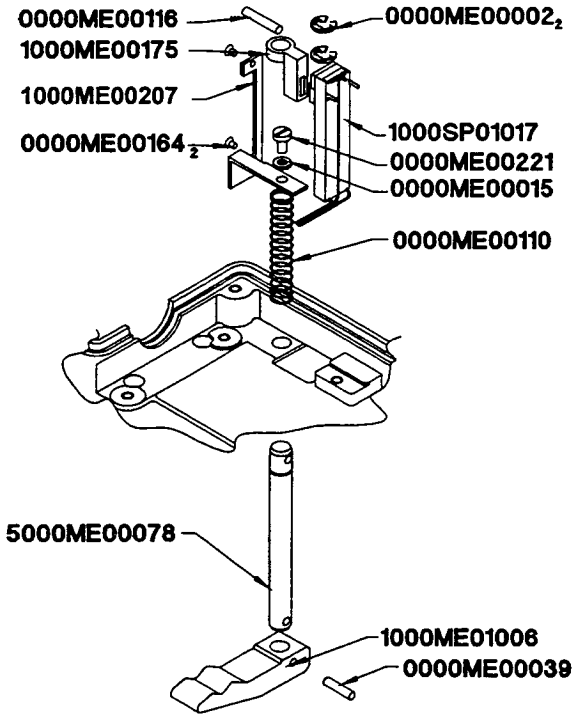
3.1.0 Remove the silicone sealing cord 1000ME01087.
3.1.1 Remove the two cover retaining screws, retain the screws and the cover for reassembly later.
3.1.2 Disconnect the beam and the flexible circuit from the control board assembly.
3.1.3 Remove the six transmission assembly retaining screws, retain these for refitting later.
3.1.4 Remove the transmission assembly from the upper case, taking care that the transmission is not damaged during this process. Retain the transmission assembly for refitting later.
3.1.5 Remove the five board retaining screws 0000ME00189 from the control board and display board assembly.
3.1.6 Remove the control board 5000EL00055 and display board 5000EL00037 assembly from the upper case assembly.

Syringe Sizing Potentiometer assembly

3.1.7 Remove the securing pin 0000ME00116 from the syringe shaft assembly, retain the pin from the assembly, see figure 1 for further information.
3.1.8 Remove the potentiometer actuator 1000ME00175 from the syringe shaft assembly, retain this for refitting later. See figure 1 for further information.
3.1.9 Remove the screw 0000ME00221 and washer 0000ME00015 securing the potentiometer assembly from the upper case, retain the screw, washer and potentiometer assembly for refitting later. See figure 1 for further information.
3.1.10 Remove the circlips 0000ME00002 retaining the spring from the syringe shaft assembly, retain the circlips and the spring for refitting later. See figure 1 for further information.

3.1.11 Remove the syringe shaft assembly from the upper case assembly.

Figure 1.



Cover Lock assembly

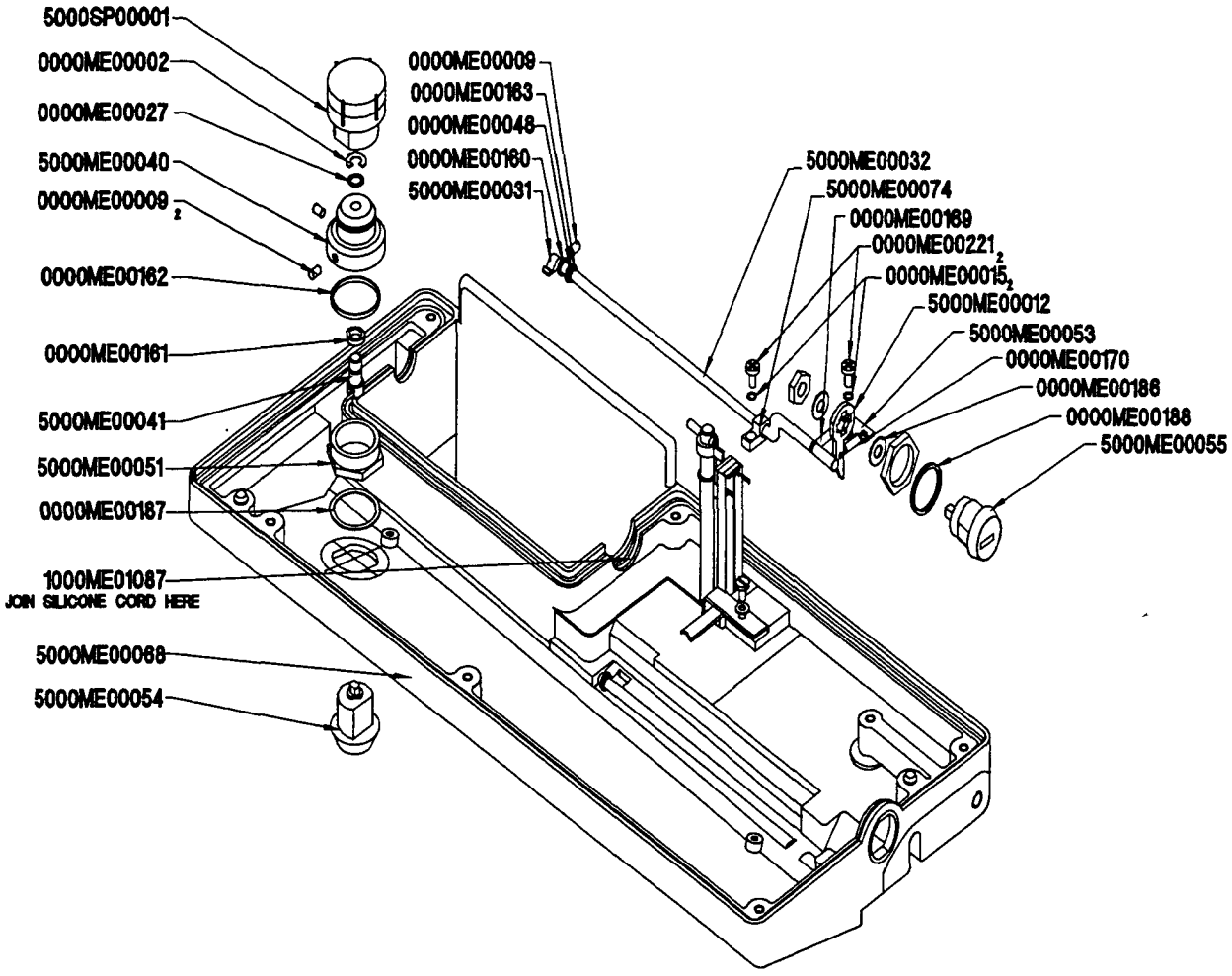
3.1.12 Remove the retaining screw 0000ME00009 from the cover lever fitted to the reverse of the upper case, retain the retaining grub screw and the lever 5000ME00031 for reassembly later. See figure 2 for future information.

3.1.13 Remove the retaining screws 0000ME00221 from the rod support and the spring plate and keep these for refitting later. See figure 2 for further information.

3.1.14 Disconnect the spring 0000ME00170 fitted between the spring plate 5000ME00053 and the lock cam plate 5000ME00012, retain this for reassembly later. See figure 2 for further information.

3.1.15 Remove the nut holding the lock to the upper case and remove the lock assembly from the upper case assembly. Keep the lock assembly, the lock mechanism and the sealing washer 0000ME00188 for refitting later. See figure 2 for further information.

Figure 2



Keyswitch assembly

3.1.16 Remove the keyswitch assembly 5000SP00001 from the power switch assembly, retain keyswitch assembly for refitting later.

3.1.17 Loosen the two lock body retaining screws 0000ME00009 so that the lock body 5000ME00040 can be removed and retained for refitting. Remove the lock sealing washer 0000ME00187, the lock nut 5000ME00051 and lock assembly 5000ME00054 from the upper case assembly. Keep these for refitting later.

Display Window

3.1.18 Remove the front panel label.

3.1.19 Remove the display window 5000ME00008 and keep this for refitting later. Ensure that the display window is not damaged during removal, as the window is fragile.

13.9 5000PB00026 ISSUE 6 (cont)

3.2 Fitting the new Upper Case

3.2.0 Refit the silicone sealing cord 1000ME01087. See figure 2 for further information

Keyswitch assembly

3.2.1 Fit the lock assembly into the new upper case supplied 5000ME00068, fit the lock assembly 5000ME00054 and sealing washer 0000ME0187, secure with the lock nut 5000ME00051. See figure 2 for further information.

3.2.2 Fit the lock body 5000ME00040 assembly, ensuring the groove in the lock assembly locates correctly into the lock spindle 5000ME00041. Refit the two lock body securing screws 0000ME00009. See figure 2 for further information.

3.2.3 Test that the lock operates correctly before refitting the keyswitch assembly.

3.2.4 Fit the keyswitch assembly 5000SP00001 to the lock assembly.

Cover Lock assembly

3.2.5 Fit the lock assembly 5000ME00055 and the sealing washer 0000ME00188 before securing with the lock nut.

3.2.6 Fit the rod assembly into the upper case. Ensure that the rod support is located correctly.

3.2.7 Fit the securing screws 0000ME00221 and washers 0000ME00015 to the spring plate 5000ME00053 and rod support 5000ME00074.

3.2.8 Fit the spring 0000ME00170 between the spring plate 5000ME00053 and the lock cam plate 5000ME00012.

3.2.9 Fit the cover latch and the securing screw to the reverse of the upper case assembly.

3.2.10 Test the cover lock to ensure the correct operation of the assembly.

Syringe Sizing Potentiometer assembly

3.2.11 Fit the syringe clamp assembly into the upper case, fit the spring 0000ME00110 and retain the spring with two circlips remove earlier 0000ME00002. See figure 1 for further information.

3.2.12 Fit the potentiometer assembly 1000SP01017 and secure with the screw and washer kept from earlier 0000ME00221 and 0000ME00015. See figure 1 for further information.

3.2.13 Fit the potentiometer actuator 1000ME00175 and secure with the pin 0000ME00116. See figure 1 for further information.

3.2.14 Test the syringe sizing potentiometer assembly to ensure the correct operation.

Control Board and Display Board Assembly

3.2.15 Fit the control board and display board assembly into the upper case, secure the assembly with the fixing screws 0000ME00189 retained from earlier.

3.2.16 Connect the beam, transmission and power switch cable assemblies to the connectors on the control board.

4.0 Fitting & Removal Instructions Lower Case

4.1.1 Disconnect the mains inlet, the handset inlet, and the battery from the power supply board.

4.1.2 Remove the four power supply board retaining screws 0000ME00187 and remove the power supply board 5000EL00038/39. See figure 3 for further information.

4.1.3 Remove the two battery plate retaining screws from the lower case assembly. Remove the battery retaining plate and the battery. Keep the plate 1000ME01004, the battery 0000EL00004 and the retaining screws 0000ME00221 for refitting later. See figure 3 for further information.

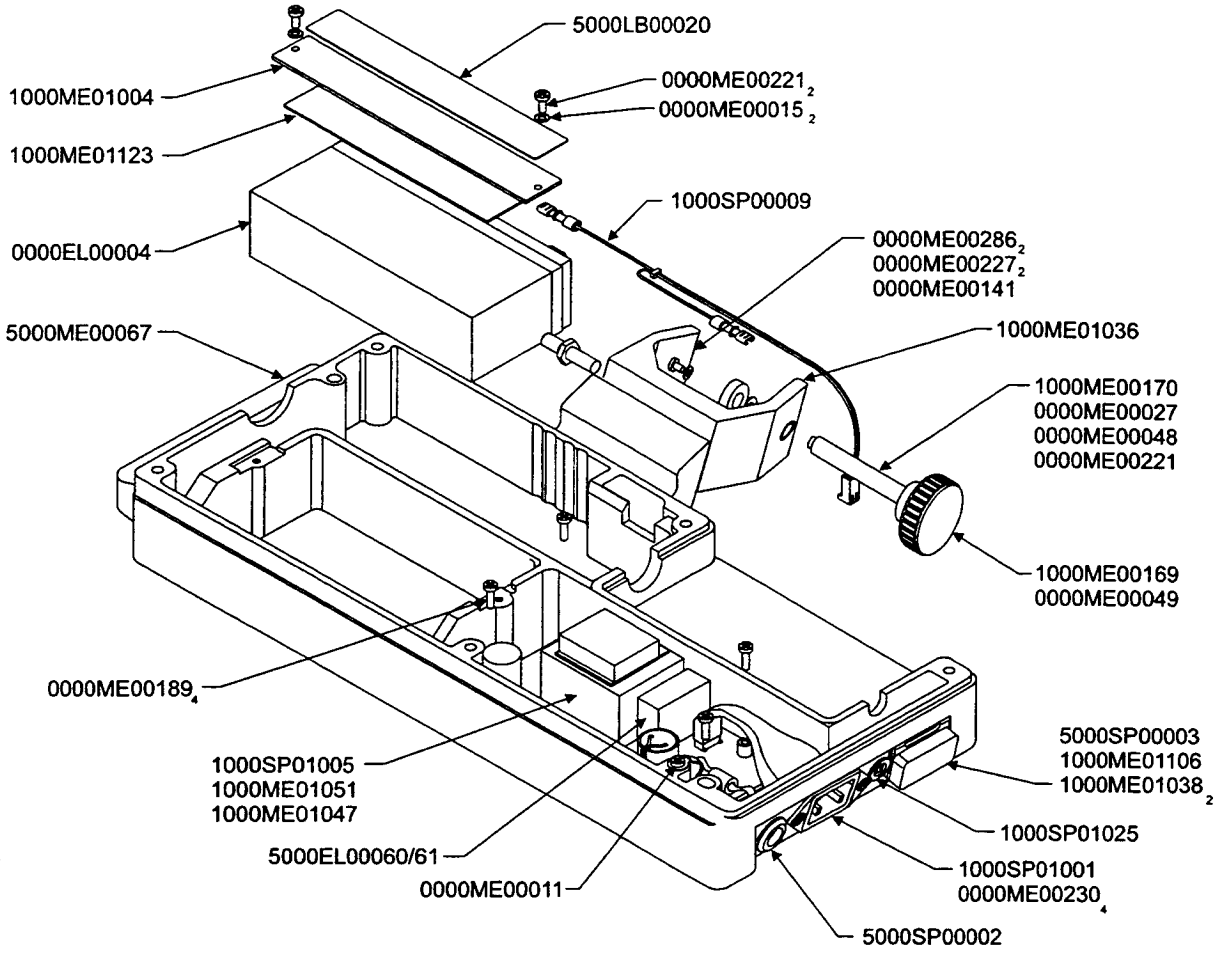
4.1.4 Remove the handset inlet connector retaining screw 0000ME00011. Remove the handset retaining nut from the handset inlet assembly 5000SP00002 and remove the handset inlet assembly from the lower case. See figure 3 for further information.

4.1.5 Remove the retaining screws 0000ME00230 from the mains inlet assembly 1000SP01001 and remove the mains inlet assembly from the lower case. Retain the mains inlet assembly for refitting later. See figure 3 for further information.

4.1.6 Remove the three pole clamp fixing screws 0000ME00227 and remove the pole clamp from the lower case assembly. Retain the fixing screws and the washers for refitting later.

13.9 5000PB00026 ISSUE 6 (cont)

Figure 3



4.1.7 Turn the lower case over and remove the four base plate fixing screws 0000ME00222 and remove the base plate 5000ME00007. Retain the fixing screws for reassembly. See figure 4 for further information.

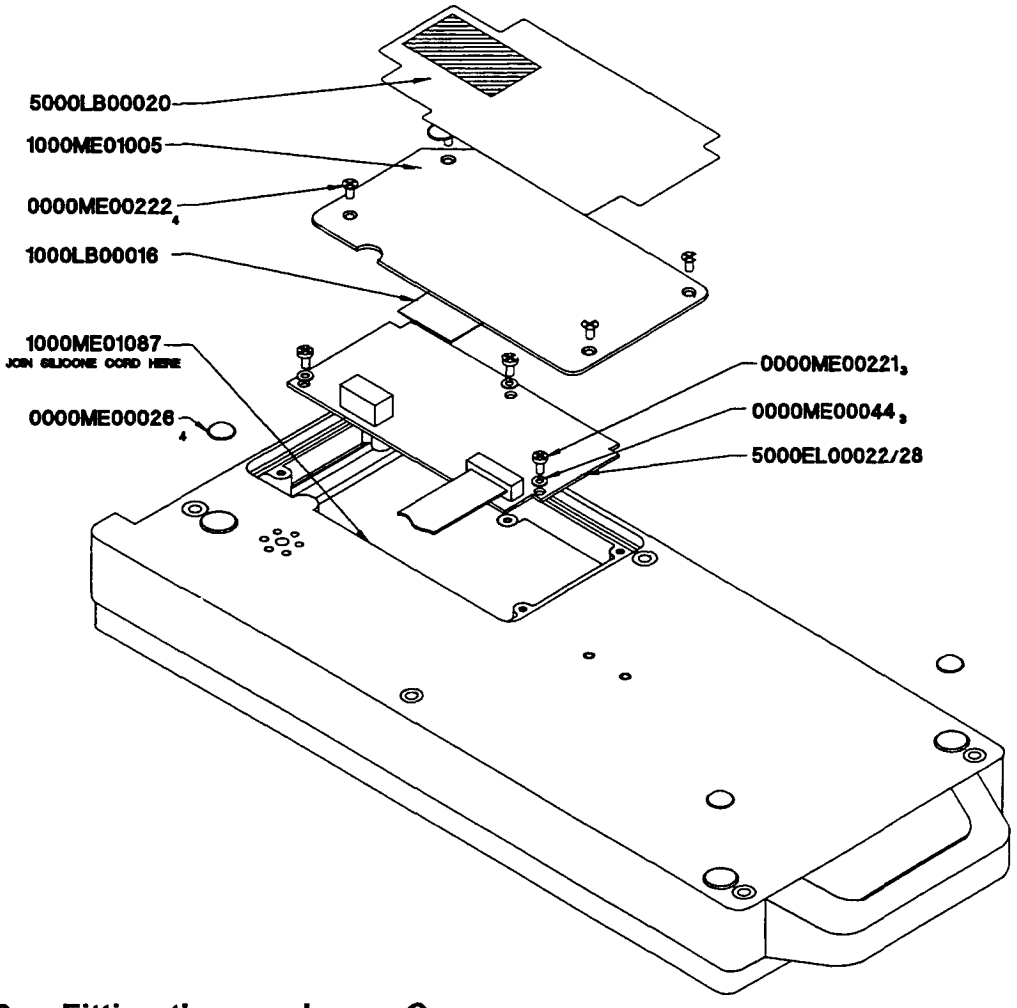
4.1.8 Disconnect the RS232/RS485 connector 5000SP00003 and the nursecall connector 1000SP01025 from the communications board 5000EL00022/28.

4.1.9 Remove the spacers 1000ME01038 and remove the RS232/485 5000SP00003 connector and seal 1000ME01074 from the lower case assembly. Retain the RS232/485 connector and spacers for reassembly later. Remove the nut securing the nursecall connector, remove the nursecall connector assembly and retain the assembly for refitting to the new lower case assembly. See figure 4 for further information.

4.1.10 Remove the three communications board fixing screws 0000ME00221 from the lower case, remove the communications board and retain the screws and the nylon washers 0000ME00044 and the communications board for reassembly. See figure 4 for further information.

4.1.11 Remove the silicone sealing cord from the groove in the lower case. Retain the cord for refitting later.

Figure 4



4.2 Fitting the new Lower Case

Communications Board 5000EL00022/28

4.2.1 Fit the RS232/485 connector assembly to the lower case 5000ME00067 supplied. Fit the new RS232 gasket 1000ME01106 and secure the assembly with the spacers 1000ME01038 remove earlier. See figure 4 for further information.

4.2.2 Fit the nursecall connector 1000SP01025 and seal to the lower case. See figure 4 for further information.

4.2.3 Feed the RS232 cable through the slot in the lower case and refit the new communications board, supplied with the fixing screws and nylon washers removed earlier.

13.9 5000PB00026 ISSUE 6 (cont)

4.2.4 Refit the RS232/485 connector and the nursecall connector to the communications board. When RS232/485 is not in use, the rubber cap in the gasket should be folded down over the connector to prevent fluid ingress through the pins.

4.2.5 Fit the silicone sealing cord into the groove in the lower case. The joint has to be in the position shown in figure 4.

4.2.6 Fit the base plate 1000ME01005 and secure with the screws 0000ME00222 retained from earlier.

4.2.7 Fit the four feet 0000ME00026 supplied in the positions shown in figure 4.

4.2.8 Copy the information from the existing base label onto the base label supplied. Fit the serial label into the window of the base panel label 5000LB00020. Fit the label onto the base plate as shown in figure 4.

Power Supply Assembly 5000EL00060/61

Note: The board supplied with 5000SP00029 is 5000EL00060 P5000 PSU 240v, the appropriate component has also been supplied to convert the board assembly to 5000EL00061 P5000 PSU 110v. Before fitting the Power Supply board the normal operating voltage of the unit must be determined. If the normal operating voltage of the unit is 240v then the modification the power supply board does not have to be carried out. If the normal operating voltage of the unit is 110v then the modification 4.2.9 has to be carried out.

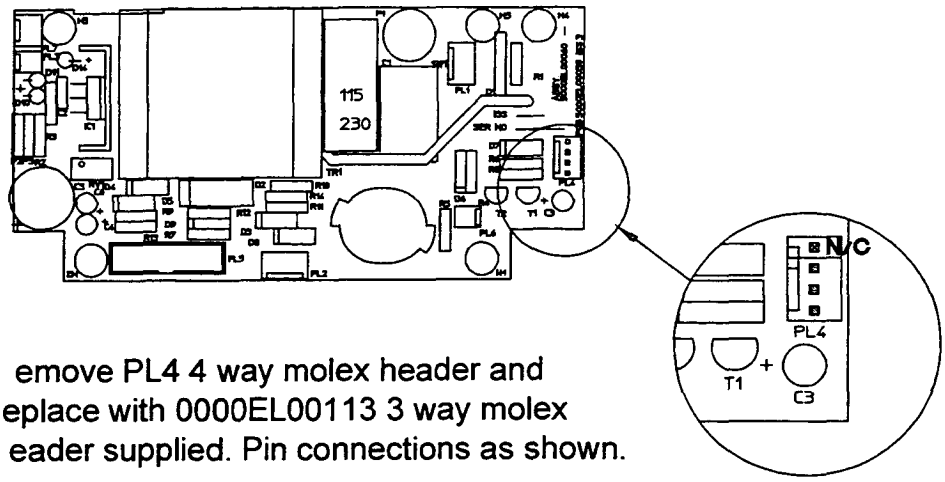
4.2.9 If the normal operating voltage of the unit is 110V then carry out this modification. Remove the fuse fitted to the power supply unit and discard, replace with 0000EL00288 Fuse 125mA 20mm Anti-Surge. Reposition the power selector switch to the 110v from the original position of 240v. This will then modify the power supply to be able to be used on a 110v mains supply.

4.2.10 Position the power supply board and alarm tube assembly into the lower case, secure using the M3x12 posi head fixing screws 0000ME00189 supplied. See figure 4 for further information.

4.2.11 Pull the existing 4 way Molex header off the board (if fitted), leaving the pins. Crop pin 1 to within 1mm of the board. Remove the pins from the 3 way Molex header supplied. Fit the bare header over the pins. Ensure that the header is pushed down onto the board and that the pins are not bent during the fitting of the header. The connector must be fitted in the same orientation as the existing connector. Pin 1 is not connected. For further information see figure 5.

13.9 5000PB00026 ISSUE 6 (cont)

Figure 5



emove PL4 4 way molex header and
eplace with 0000EL00113 3 way molex
eader supplied. Pin connections as shown.

Lower Case Assembly

4.2.11 Fit the appropriate end label supplied 5000LB00020 in the same position as the end label fitted to the existing lower case.

4.2.12 Fit the mains inlet connector and gasket secure the assembly with the two M3 X 8 csk fixing screws 0000ME00230 supplied.

4.2.13 Fit the handset inlet connector assembly 5000SP00002 fit the two sealing washers supplied into the steps in the case. Secure the handset inlet connector with the nut supplied. Secure the handset ground connector to the lower case using the fixing screw 0000ME00011 retained from earlier.

4.2.14 Fit the mains inlet connector, the handset connector and the alarm tube connector to the power supply board. See figure 3 for further information.

4.2.15 Fit the battery and battery plate into the lower case and secure using the 2 fixing screws and washers 0000ME00221 and 0000ME00015 retained from earlier, ensure that the cable assembly is loomed so the cable is tucked in the slot in the lower case under the battery plate. Fit the battery connector to the power supply board. See figure 3 for further information.

4.2.16 Fit the pole clamp retained from earlier and fix with the three retaining screws 0000ME00227 and washers 0000ME00045 kept from earlier.

5.0 Upper and Lower Case Assembly

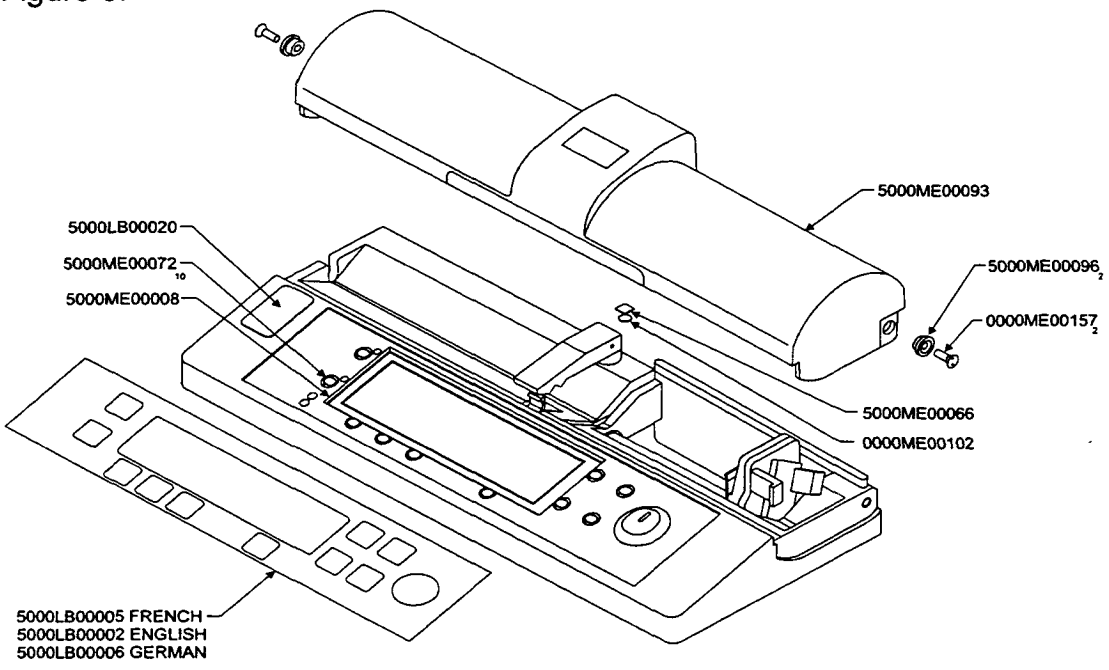
5.2.0 Add the letters 'CU' to the build issue label located in the lower case assembly.

5.2.1 Reconnect the cable assemblies between the control board and the power supply board.

13.9 5000PB00026 ISSUE 6 (cont)

5.2.2 Ensure that the cable assemblies are not trapped when the upper and lower case assemblies are fitted together.
5.2.3 Fit the six case fixing screws and washers retained from earlier.
5.2.4 Turn the unit over and refit the display window 5000ME00008, see figure 6 for further information.
5.2.5 Ensure that all the spacer buttons have been refitted, see figure 6 for more information. Ensure that the buttons operate correctly.
5.2.6 Ensure that the front panel recess in the upper case is clean and free from dust, before fitting the appropriate front panel label.
5.2.7 Fit the key operation label 5000LB00020, the position is shown in figure 6.
5.2.8 Fit the buffer label 5000ME00066 and the fixing disc 0000ME00102, the position is shown in figure 6.
5.2.9 Fit the cover assembly as shown in figure 6. Ensure the correct operation of the cover mechanism.
5.2.10 Fit the IVAC logo label 5000LB00020 to the lower case in the same position as the logo label on the old lower case.
5.2.11 Connect the handset assembly and test the correct operation of the handset assembly.
5.2.12 Complete a self test routine as described in the technical service manual.

Figure 6.



6.0 Technical Inquiries.

For additional technical assistance, contact your local ALARIS Service Operations.

13.10 5000PB00029 ISSUE 2

Fitting Instructions Keyswitch Upgrade P5000

This instruction applies only to **IVAC** 'P' Series Syringe Pumps.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure all the test calibration procedures are carried out as recommended in the technical service manual after any component fitting.

For further information refer to final assembly drawing no. 5000PP00001 and relevant component replacement sections as detailed in the service manual, publication numbers 5000PB00004 when following this instruction.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work service when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 5000JG00001.

1.0 Introduction

This fitting instruction applies to the fitting of the up-issued of the keyswitch assembly on the P5000.
This up-issue applies to P5000 units with build issues under 56. Units with build issues over 56 already have the up-issued keyswitch assembly fitted.
To complete the instruction outlined in the publication you will require the spare upgrade kit 5000SP00035.

2.0 Access to the Pump

2.1 Place the unit on a static dissipative surface that is correctly grounded.
2.2 Remove the six case retaining screws (M4 x 45mm pan head) located on the base of the unit and withdraw the base plate.
2.3 Carefully separate the upper and lower case halves and disconnect the grey ribbon cable from the socket on the power supply PCB.

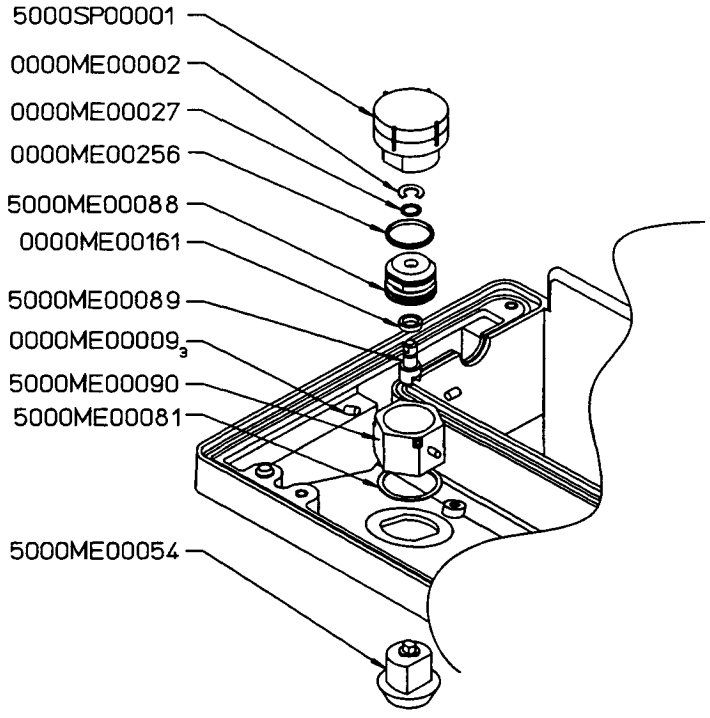
3.0 Fitting Instructions

3.1 Remove the Keyswitch Connector assembly 5000SP00001 from the Keyswitch Assembly in the upper case.

3.2 Loosen the three lock body retaining screws from the lock assembly. Remove the lock body assembly from the upper case.

3.3 Retain the lock for refitting later. Remove the spindle retaining circlip 0000ME00002 and M5 plain washer 0000ME00027 from the assembly and remove the spindle from the lock body. Remove the o-ring 0000ME00161 and retain for refitting later. See figure 1 for further information.

Figure 1.



3.4 Fit the o-ring 0000ME00256 (supplied) to the Lock body 5000ME00088 (supplied). Fit the o-ring 0000ME00161 to the spindle supplied 5000ME00089 (supplied). Fit these into the lock body 5000ME00088 and secure with the washer 0000ME00027 and circlip 0000ME00002, remove earlier. See figure 1 for further information.

3.5 Fit the Keyswitch connector assembly 5000SP00001 to the lock body assembly, see figure 1 for further information.

3.6 Fit the lock 5000ME00054 back into the upper case, fit the sealing washer 5000ME00081 (supplied). Fit the lock nut to secure the assembly.

3.7 Fit the 3 set cup screw 0000ME00009 (supplied). Back off a turn the two screws which are the least accessible and secure the most accessible.
3.8 Fit the keyswitch connector into the control board.
3.9 Test the operation of the keyswitch assembly and carry out the self test routine as detailed in the technical service manual.

4.0 Technical Inquiries.

For additional technical assistance, contact your local ALARIS Service Operations.

13.11 0000TB00032 ISSUE 1

Technical Bulletin Software V2R6 P5000

This software upgrade can be fitted to all P5000 units.

1.0 Description

The software for the P5000 units has been upgraded to incorporate the following customer requests.

1.1 Swedish language added.

1.2 Maximum limits programmable for Loading Dose, Continuous Dose and Lockout limits.

1.3 Syringe type locking added.

1.4 Occlusion limits increased to allow for epidural sets with filters.

1.5 Occlusion icon display changed to match the P3000 and P7000.

1.6 Drug name entry speed improved.

1.7 PCA Lockout retained if the pump is switched to SET and then to RUN before the lockout expires.

1.8 PCA dose of 0mg available to prevent handset deliveries for epidural use.

1.9 Occlusion levels now selectable with each protocol.

1.10 Addition of the Evans Rapiject syringe.

2.0 Technical Inquiries.

For additional technical assistance, contact your local Alaris Service Operation.

13.12 0000TB00038 ISSUE 1

Alternative Routing for the P1-3, P4 & P5 Flexible Circuit

This bulletin applies to P series pumps from the following serial numbers onwards:

1001-16138, 2001-18755, 3001-17130, 4001-11824, 5000-02094

1.0 Description of Change

1.1 Previous versions of the P series pumps routed the flexible circuit (1000SP01006, 1000SP01040 or 1000SP01041) for the transmission assembly underneath the chassis plate and through a cut-out in the linear grid up to the motor. This left a section of flexible circuit which, in certain circumstances, could get caught in the mechanism. Although this did not affect the functionality of the pump, it was decided that an alternative routing should be devised. This is to be implemented on all the pumps listed above.

1.2 The new method takes a different route under the chassis plate and uses one additional foam pad (part number 1000ME01066) to hold the circuit in place. It creates a shorter section of flexible circuit going to the motor and fits into the case better, avoiding any collision problems. However, the basic cut-out of the flexible circuit is identical.

1.3 A schematic of the new routing is shown in Fig 1. below, but for more details, refer to the fitting instructions for the flexible circuit 1000PB00135.

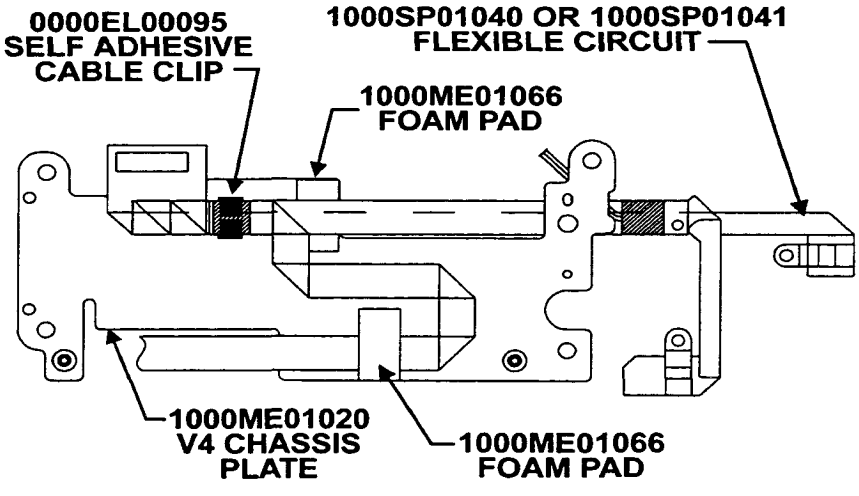


Figure 1.

13.12 0000TB00038 ISSUE 1

2.0 Impact of Change

2.1 The change does not affect the functionality of the pumps, so it is not necessary to upgrade any older pumps to have this routing of flexible circuit. However, be aware that the folds shown on older drawings of the flexible circuit or transmission will no longer match the latest pumps being supplied.

2.2 Any spare flexible circuits that are ordered in future will be supplied with folds already in them according to the new routing. When fitting these circuits, it will be necessary to refer to the fitting instructions 1000PB00135.

3.0 Technical Inquiries

For additional technical assistance, contact your local Alaris Service Operations.

13.13 0000TB00041 ISSUE 1

Flexible Circuit Added to Beam Assembly

This bulletin applies to all P series pumps from the following serial numbers onwards:

1.0 Description of Change

1.1 There have been reports of early field failures of a small quantity of beam assemblies (1000SP00003). On investigation, it was discovered that the majority of these were due to damage of the red insulated interconnecting wires between the various elements of the strain gauge. After several thousand operations, it is possible for these wires to become overstressed and either

- The insulation becomes damaged, causing the circuit to be shorted to the beam

OR

- One of the cables breaks from its solder joints, as a result of being bent around the beam.

1.2 In order to combat these two failure modes, a new flexible circuit has been introduced to replace the interconnecting wires. This, together with the adhesive backing on the flexi, can take up the strain a lot better and has been proven to last in excess of 20,000 cycles. The arrangement of the flexi means that there is no possibility of the remaining interconnecting wires shorting to the metal of the beam itself. Since they are not required to wrap around the beam, they are not likely to become overstressed.

1.3 At the same time, the colour of the wiring loom has been changed to all grey, instead of a multi-coloured loom, so that the two types can easily be distinguished.

2.0 Upgrading Pumps

2.1 It is not necessary to upgrade any pumps in the field, since so few beam assemblies have failed. The P series pumps also have an error detect mechanism such that if the beam does fail, an alarm will occur.

2.2 However, all beam assemblies ordered from 5th May 1997 will be of the new type. These will also be fitted to all P series pumps manufactured from this date onwards.

3.0 Technical Inquiries

For additional technical assistance, contact your local ALARIS Service Operations.

13.14 0000TB00043 ISSUE 1 (cont)

PCAM Loading Dose Clarification

1.0 Introduction

Following a customer query as to the operation of loading doses in the PCAM instrument, this document has been prepared for the purpose of clarification.

2.0 Observation

If a pre-set protocol has a loading dose of greater than zero, and the loading dose in general options (accessed by code 251) is subsequently set to 'no', the PCAM will still administer a loading dose.

If the loading dose option is switched to 'no', the protocol summary viewed upon switching the pump to the 'set' position will not show the loading dose, which will only become apparent when switching to the 'run' position when loading dose infusion commences.

This administration of a loading dose can only be cancelled by modifying the pre-set protocol to a loading dose of zero prior to setting the loading dose option to 'no'.

This only applies to software revisions below V2R6.

3.0 Technical Inquiries.

For additional technical assistance, contact your local ALARIS Service Operations.

13.15 0000TB00054 ISSUE 1

Revised Syringe Size Calibration P5000

This bulletin applies to all P5000 syringe pumps.

1.0 Introduction

Following a customer query, an anomaly has been detected in the recognition of certain syringes on the P5000.

This is due to the change in manufacturing process of the upper case, which means that the low level calibration point is not in the same position.

Thus, the calibration spacer has been redesigned to include a low level calibration point. This allows recognition of all listed syringes on all P5000 units.

2.0 Procedure

2.1 Enter the access code 243.

2.2 The display will show **'Clamp Down: xx'** where xx represents the current decimal reading from the linear potentiometer.

2.3 Position the narrow end of the syringe size calibration spacer (0000TG00055) under the syringe clamp in the place where the syringe would normally fit. Ensure the wider end of the spacer overhangs above the outer tube , and that there is adequate clearance so as to provide no interference with the outer tube seal. Check the value is within the tolerance band displayed on the screen.

2.4 Press ⇑**CALIBRATE** to enter the base value.

2.5 Leaving the spacer in the same orientation and position, press ⇑**NEXT.** The display will read 'Fit spacer (typ. 170..210): xx' where xx represents the current decimal reading from the linear potentiometer.

2.6 Position the wider end of the syringe size calibration spacer (0000TG00055) under the syringe clamp in the place where the syringe would normally fit, again ensuring the narrower end of the spacer overhangs above the outer tube, and that there is adequate clearance so as to provide no interference with the outer tube seal. Check the value is within the tolerance band displayed on the screen.

2.7 Press ⇑**CALIBRATE** to enter the value.

2.8 The display will read 'Difference (19mm): xx' where xx is the value that has been stored. Record the three values on the test sheet.

2.9 Press ⇑**QUIT** to return to normal operation of the pump.

3.0 Technical Inquiries.

For additional technical assistance, contact your local ALARIS Service Operations.

13.16 0000TB00056 ISSUE 1

Technical Bulletin -Fluid Sealing Enhancements

This bulletin applies only to P series syringe pumps with serial numbers in the following range:

1001-00001 to 1001-20135, 2001-00001 to 2001-20374
3001-00001 to 3001-20100, 4001-00001 to 4001-20018
5001-00001 to 5001-02387, 7001-00001 to 7001-03092

1.0 Introduction

Pumps with serial numbers listed above can have a modification fitted to improve the existing fluid ingress protection. All units with serial numbers greater than those listed above have the improvements fitted as standard. Upgrade kits are also available to enhance the fluid sealing properties of the product. It is not a mandatory requirement to upgrade units to this specification but in hospitals where fluid ingress has been a problem, it would be recommended.

A range of changes have now been made to all product currently being shipped, as listed below:

1. Changes to the Transmission Mechanism to fully seal the syringe plunger holder and leadscrew area. This includes a new backplate seal, backplate, declutch lever and outer tube, plus several additional O rings. The addition of the kit means that some syringes cannot be filled as far as previously.

Note: For example a BD50 can now only be filled to 58ml, rather than 60ml, although the majority of the syringes specified for use with the P series can still be filled to their maximum point.

2. Change to the lower case on P1000/2000/3000 and P4000 only. The lower case now has a drainage channel that prevents fluid from building up in the area around the plunger holder when the pump is placed on a pole with a normal ALARIS Pole Clamp.
3. Re-design of the On/Off Splash Cover.
4. Change to the design of the RS232 gasket to incorporate a rubber cap that fits over the connector when RS232 connector is not in use.

2.0 Upgrades Kits Available

In order to simplify the ordering system for customers wishing to upgrade units in the field, three upgrade kits have been created. These kits combine together several of the improvements, as outlined below. All of the kits are supplied with comprehensive fitting instructions outlining how to retrofit the upgrade to older pumps and can now be ordered from ALARIS Medical Systems.

2.1 1000SP01046 - Applicable to All P Series units Built After 1995

This kit contains all of the parts required to upgrade and fully seal the transmission, with appropriate fitting instructions. It also contains a new On/Off splash cover, plus a replacement RS232 Gasket plus cap, should it be required.

2.2 1000SP01048 – Applicable to P1000/2000/3000 and P4000 Units at Build Issue 20 or Below

Previously an upgrade kit was available for early version 4 units (1000SP01037) which contained a new case sealing cord, a new mains inlet gasket, a new leadscrew gasket and a new seal for the alarm tube. 1000SP01048 have superseded 1000SP01037; the new kit also includes the new RS232 gasket, new on/off seal and the transmission upgrade parts.
This upgrade is recommended for an old unit without the previous upgrade.

2.3 1000SP01033 –Fitted to P1000/2000/3000 and P4000 Units Only

This kit contains the new lower case half with a drainage channel, plus the required labels, etc. It also contains a new On/Off Splash cover and RS232 gasket with cap and Fitting Instructions.

3.0 Recommendations About the Kits

In order to be most confident that a unit will prevent fluid ingress, it should be fitted with all of the upgrades mentioned in this bulletin. However, fitting of the transmission upgrade involves dis-assembly and re-assembly of the transmission. ALARIS would advise should only be carried out by qualified personnel. As a result, ALARIS would recommend the following:

- **P1000/2000/3000/4000 Units** – It is simpler to just fit a new lower case, (Spare Kit - 1000SP01033). It is recommended that the kits 1000SP01046 and 1000SP01048 should only be fitted when there is a history of fluid ingress.

- **PCAM and P7000 Units** – It is recommended that the transmission be sealed using kit 1000SP01046 when the pump has a history of fluid ingress.

Note: If fitting to a P7000 unit, it must be fitted with software version V1R6 or above, otherwise it is not possible to fully calibrate the linear position potentiometer.

4.0 Technical Enquiries

For further information, please contact your local ALARIS Technical Service department.

13.17 000TB00057 ISSUE 1

Technical Bulletin - Recommendation of DC/AC Inverter

This bulletin applies to all Version 4, P5000, P6000, TIVA & P7000 syringe pumps.

1.0 Introduction

Following customer requests for a means to run the above pumps from a 12V power supply, a range of dc/ac inverters have been tested for compatibility with the IVAC syringe pumps. The inverter that passed all the tests satisfactorily is called the PROwatt 150watt Inverter. It is manufactured by STATPOWER Technologies Corporation, Canada and is distributed in the UK by The Merlin Group. This inverter is therefore being recommended for use with V4, P5000 and P7000 syringe pumps in ambulances etc.

2.0 Results from Testing

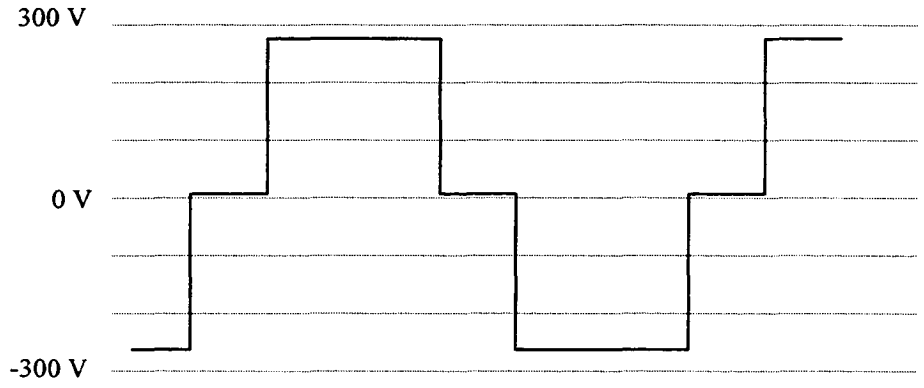
Alaris Research & Development, Beechwood carried out the following tests.

2.1 Performance when running from a vehicle's battery.

A P7000 and P1000 (V4) were run from a PROwatt 150watt Inverter, attached to a vehicle's battery via the cigarette lighter socket, for a total of approximately 13 hours. There were no problems experienced in this situation.

2.2 Output Waveform

- The drawing below is a visual representation of the modified sinewave output of the PROwatt 150watt Inverter.



- Maximum is approximately 280V, minimum is approximately –260V.
- The frequency is 50Hz.
- There are no spikes in the waveform, even when the attached pump is turned on and off.

- The inverter cuts out (stops) and alarms when the input voltage is either too high (>15V) or too low (<10V).
- The rms. is approximately 240VAC.

2.3 Volumetric and Temperature Test.

A P7000 was run via the PROwatt 150watt Inverter (attached to a 12V power supply) at 5ml/hr. The pump and inverter were placed in an environmental test chamber running at 40°C (this is the top limit of both the pump and inverter temperature specification). A 2 hour volumetric test was then performed on the pump.

The linear accuracy of the pump in these conditions is +1.36%, which is within the specification for the P7000 (+/-2%). The heatsink is approximately 1°C above ambient.

3.0 Inverter Details

Addresses for Distributors in Europe:

UK & Mainland Europe
Statpower Technologies Limited
Unit 1, Hithercroft Court
Lupton Road
Hithercroft Industrial Estate
Wallingford
Oxfordshire OX10 9BT

Tel: +44 (0) 1491 824333
Fax: +44 (0) 1491 824466

Germany & Netherlands
Statpower Technologoies GmbH
Technologiezentrum Jülich
Karl-Heinz-Beckurts-Str.13
D-52428 Jülich
Germany

Tel: +49 (0) 2461 690770
Fax: +49 (0) 2461 690779

Current cost for a single PROwatt 150watt Inverter in the UK is £86.

4.0 Technical Inquiries.

For further information, please contact your local Alaris Technical Service Department.

13.18 0000TB00058 ISSUE 1

Technical Bulletin – Syringe Plunger Detect Problems

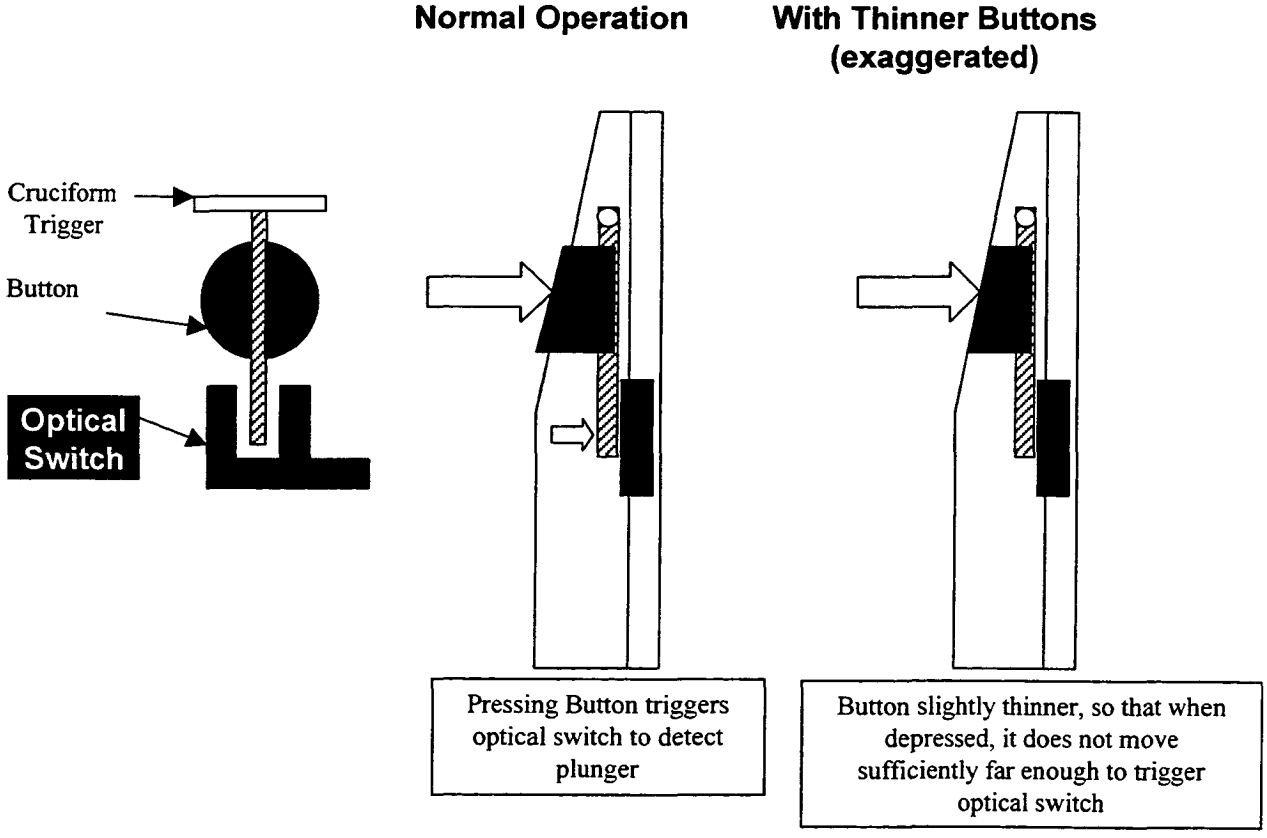
This bulletin applies only to P series syringe pumps built with the following serial numbers:

1001-20135 to 1001-20382, 2001-20374 to 2001-20598
3001-20100 to 3001-20341, 4001-20018 to 4001-20029
5001-02387 to 5001-02484, 6001-00100 to 6001-00203
6002-00020 to 6002-00211, 7001-03092 to 7001-03196

1.0 Description of Fault

The units listed were fitted with a new moulded plunger detect button. The first batch of these buttons were slightly undersize and this has caused some problems with syringe detect on a number of units. The units will detect larger syringes (ie. 50, 100ml) of most makes, but have failed to detect smaller syringes properly.

The reason for the problem is as shown below:


Normal Operation
With Thinner Buttons (exaggerated)
Cruciform Trigger
Button
Optical Switch
Pressing Button triggers optical switch to detect plunger
Button slightly thinner, so that when depressed, it does not move sufficiently far enough to trigger optical switch

13.18 0000TB00058 ISSUE 1 (cont)

This problem was quickly recognised and, as a temporary measure before new buttons could be obtained, foam pads were fitted inside the plunger holder to rectify the units shipped. The majority of the units shipped in this serial number range were fitted with these pads. Testing of the pads in house showed that all units fitted with these pads were able to detect the full range of syringes as normal, so it was deemed acceptable that they be shipped.

This bulletin is intended to raise awareness of the problem, in case customers continue to experience problems. A longer-term solution is to replace the plunger button with a new one (1000ME01114),
since the problem has now been rectified. This replacement need only be done to units where problems have occurred; it is not mandatory.

Before attempting any rectification, test the unit as follows:

- Enter service code "125" and press the stop button until the plunger detect test is found. This is 8-0/8-1 on P1/2/3/4 and will be indicated in the text on other P series pumps.
- Try fitting a plunger from a standard 50ml syringe into the plunger holder, in a variety of different positions, approximately 10 times. Do the same with a smaller 10ml syringe.
- Providing the syringes are detected every time (indicated by a change from 0 to 1 on the display), it may not be necessary to carry out the rectification. Otherwise, refer to the rectification instructions below.

2.0 Access to the Pump.

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work surface when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 0000JG00004.

13.18 0000TB00058 ISSUE 1 (cont)

- Place the unit on a static dissipative surface that is correctly grounded.
- Remove the six case retaining screws (M4 x 45mm Pan Head) located on the base of the unit.
- Carefully separate the upper and lower case halves and disconnect any ribbon cables that link the two halves.

3.0 Rectification Required

- Remove the grub screw that secures the declutch lever.
- Remove the four black countersunk screws that secure the backplate of the plunger holder.
- Remove the plunger detect button, plus the white cruciform from the plunger holder. Push out the pin that holds the cruciform and make up a new button assembly, using a new button (1000ME01114). Remove the O ring from the old button with pliers and fit it around the new button. Apply silicone grease to the outside of the button to ensure that it operates smoothly. Refit the new assembly into the plunger holder.
- Check that the two small springs that activate the plunger button are correctly fitted back into the new button. Replace the backplate and secure the four black countersunk screws.
- Check that the button springs back freely after being pressed. If not, it may be that one of the springs is not correctly located, or there is not enough grease on the button. Remove the backplate once more and rectify this as required.
- Refit the declutch lever. Apply Loctite 242 (part number 0000ME00051), or equivalent to the screw before refitting to ensure that it remains fixed in position. When fitting the screw, make certain that the end point of the grubscrew goes through the hole in both the plastic backplate seal and the hole in the intermediate tube.
- Re-assemble the unit, by re-connecting all of the ribbon cables and secure the two halves together with the six M4x45 case screws.
- Carry out a "123" self test, as described in the Directions For Use, to check full functionality of the pump before returning it to a clinical situation. In particular, repeat the test of the plunger detect system using a 50ml syringe and a 10ml syringe to confirm that the modification has been carried out correctly.

4.0 Technical Enquiries

For further information, please contact your local Alaris Technical Service department.

13.19 0000TB00059 ISSUE 1

Technical Bulletin – Transmissions Tight When Declutched

This bulletin applies only to P series syringe pumps built with the following serial numbers:

1001-20135 to 1001-20382, 2001-20374 to 2001-20598
3001-20100 to 3001-20341, 4001-20018 to 4001-20029
5001-02387 to 5001-02484, 6001-00100 to 6001-00203
6002-00020 to 6002-00211, 7001-03092 to 7001-03196

1.0 Introduction

The units listed above were the first to be fitted with the new fluid sealing upgrade. This prevents ingress of fluid along the leadscrew when the area around the plunger holder is filled with fluid for extensive time periods. One component of this upgrade is an O ring that fits into a new plastic backplate seal (part number 1000ME01111) and seals the leadscrew.

Whilst some increase in tightness is to be expected, due to the O ring introducing additional friction, it has been noticed that, in a few cases, the transmission is excessively tight and difficult to move when declutched.

This problem has been investigated and found to be caused by the leadscrew rubbing on the plastic part of the new seal, rather than running smoothly on the O ring. This was due to tolerance variations on the first batch of seals.

Since it is due to tolerance variation, not all of the pumps in this serial number range are affected, the majority being as smooth as normal.

In order to overcome the problem initially in manufacturing, silicone grease was applied to the internal O ring and plastic, which made the declutch action a lot better, for all products shipped.

However, it is possible that the grease will dry out. Whilst the user can simply re-apply grease to the seal, a better long-term solution is to replace the backplate seal with a new one. The design of this part has now been adjusted slightly to prevent any tightness, even in the extremes of the tolerance range.

This replacement need only be done to units where problems have occurred; it is not mandatory.

If a transmission is found to be excessively tight, then a new backplate seal (1000ME01111), plus two replacement O rings (0000ME00237 and 0000ME00277) should be ordered. Refer to the following sections for details of how to remove the old part and refit the new one.

These parts cannot be fitted to older product with serial numbers below those shown, unless they have already been upgrade with the fluid sealing kits 1000ME01046 or 1000ME01048.

2.0 Access to the pump

Ensure the unit is disconnected from AC power supply and switched off before attempting to service the unit.

This equipment contains static sensitive components. Observe strict precautions for the protection of the static sensitive components when attempting to repair and service the equipment.

Ensure that no undue force is applied to the plunger holder and the leadscrew, when the unit is placed upside down to remove the six case retaining screws (M4 x 45mm pan head) on the base.

Always protect the plunger holder and leadscrew by spacing the front face of the pump off the work surface when the pump is upside down. A 50ml syringe placed in the syringe clamp may be used if necessary, but for regular servicing we recommend the use of the upper case support cradle Part No. 0000JG00004.

2.1 Place the unit on a static dissipative surface that is correctly grounded

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2.2 Remove the six case retaining screws (M4 x 45mm Pan Head) located on the base of the unit.

2.4 Carefully separate the upper and lower case halves and disconnect any ribbon cables that link the two halves.

3.0 Rectification Required

3.1 Remove the six screws that retain the transmission in the upper case and unplug the various connectors for the flexible circuit, beam, etc that connect the transmission to the control PCB. Remove the transmission assembly.

3.2 Remove the beam assembly from the end of the leadscrew, by removing the M3 nut from the end. Also remove the leadscrew seal. Retain all parts for re-assembly later.

3.3 Remove the grub screw that secures the declutch lever and remove the lever.

3.4 Remove the four black countersunk screws that secure the backplate of the plunger holder.

3.5 Remove the backplate, plus the plastic backplate seal, 1000ME01111, and discard this.

3.6 Assemble the replacement seal, by inserting the smaller O ring (0000ME00237 6.5x1) into the internal recess at the end of the seal and fitting the larger O ring (0000ME00277 11.5x1.5) in the external groove.

3.7 Apply silicone grease around the outside of the seal, over the O ring, to help lubricate it.

3.8 Push the replacement seal into the backplate and refit the backplate onto the plunger holder, with the four countersunk screws. When doing this, check that the two small springs that activate the plunger button are correctly fitted back into the new button.

3.9 Check that the button springs back freely after being pressed. If not, it may be that one of the springs is not correctly located, or there is not enough grease on the button. Remove the backplate once more and rectify this as required.

3.10 Refit the declutch lever. Apply Loctite 242 (part number 0000ME00051), or equivalent to the screw before refitting to ensure that it remains fixed in position. When fitting the screw, make certain that the end point of the grubscrew goes through the hole in both the plastic backplate seal and the hole in the intermediate tube.

3.11 Replace the leadscrew seal and the beam assembly, tightening the M3 nut securely.

3.12 Refit the transmission into the upper case. The four screws that hold down the chassis plate should be torqued to 1Nm, whilst the two screws for the beam should be 2Nm. Refit all the connectors onto the control board.

3.13 Re-assemble the unit, by re-connecting all of the ribbon cables and secure the two halves together with the six M4x45 case screws.

3.14 Carry out a "123" self test, as described in the Directions For Use, to check full functionality of the pump before returning it to a clinical situation. In particular, since the beam has been removed, an occlusion test should be carried out and, if necessary, the occlusion detect system should be re-calibrated, in accordance with the instructions in the relevant Technical Service Manual.

4.0 Technical Enquiries

For further information, please contact your local ALARIS Technical Service department.